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200-BP-11 Operable Unit and 216-B-3 Main Pond Work/ Closure Plan, Hanford Site, Richland, Washington

Volume 1: Field Investigation and Sampling Strategy

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ACRONYMS AND ABBREVIATIONS

AAMS	Aggregate Area Management Study
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirements
BHC	benzene hexachloride
BHI	Bechtel Hanford, Inc.
COC	contaminants of concern
CRDL	Contract-Required Detection Limit
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CMO	corrective measures objective
CMP	corrective measures plan
CMR	corrective measures requirement
CMS	corrective measures study
DQO	data quality objective
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
Ecology	Washington Department of Ecology
EII	Environmental Investigations Instruction
ETF	Effluent Treatment Facility
EPA	U.S. Environmental Protection Agency
ERA	expedited response action
GPR	ground-penetrating radar
HASQAP	Hanford Analytical Services Quality Assurance Plan
HEIS	Hanford Environmental Information System
HSBRAM	Hanford Site Baseline Risk Assessment Methodology
HSWA	Hazardous and Solid Waste Amendments
IRM	interim remedial measure
LERF	Liquid Effluent Retention Facility
LFI	limited field investigation
msl	mean sea level
MSCM-II	Mobile Service Contamination Monitor II
MTCA	Model Toxics Control Act
OEMP	Operational Environmental Monitoring Program
PCB	polychlorinated biphenyl
PUREX	Plutonium/Uranium Extraction
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QC	quality control
QRA	qualitative risk assessment
RCRA	*Resource Conservation and Recovery Act*
RFI	RCRA facility investigation
RFI/CMS	RCRA Facility Investigation/Corrective Measures Study
RLS	radionuclide logging system
ROD	record of decision
TEDF	Treated Effluent Disposal Facility
Tri-Party Agreement	*Hanford Federal Facility Agreement and Consent Order*
TSD	treatment, storage, and/or disposal

ACRONYMS AND ABBREVIATIONS (cont.)

TBC	to be considered
USRADS	Ultrasonic Ranging and Data System
WAC	Washington Administrative Code
WHC	Westinghouse Hanford Company

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1.0 INTRODUCTION

This document coordinates a *Resource Conservation and Recovery Act* (RCRA) past-practice work plan for the 200-BP-11 Operable Unit and a RCRA closure/postclosure plan for the 216-B-3 Main Pond and 216-B-3-3 Ditch [treatment, storage, and/or disposal (TSD) unit]. Both RCRA TSD and past-practice waste management units are contained within the 200-BP-11 Operable Unit. The 200-BP-11 Operable Unit is a source operable unit located on the east side of the B Plant Source Aggregate Area in the 200 East Area of the Hanford Site (Figures 1-1 and 1-2). The operable unit lies just east of the 200 East Area perimeter fence and encompasses approximately 476 hectares (1,175 acres).

Source operable units include waste management units that are potential sources of radioactive and/or hazardous substance contamination. Source waste management units are categorized in the *Hanford Federal Facility Agreement and Consent Order* (Tri-Party Agreement, Ecology et al. 1994) as either RCRA TSD, RCRA past-practice, or *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) past-practice. As listed below and in the Tri-Party Agreement, the 200-BP-11 Operable Unit contains five RCRA past-practice and five RCRA TSD waste management units. Additionaly, for RCRA TSD permitting purposes, the RCRA TSD waste management units are subdivided into two RCRA TSD units.

RCRA Past-Practice Waste Management Units	RCRA TSD Waste Management Units
216-B-3-1 Ditch	*216-B-3 Main Pond TSD Unit*
216-B-3-2 Ditch	216-B-3 Main Pond
216-E-28 Contingency Pond	216-B-3-3 Ditch
UN-200-E-14 Unplanned Release	
UN-200-E-92 Unplanned Release	*216-B-3 Expansion Ponds TSD Unit*
	216-B-3A Expansion Pond
	216-B-3B Expansion Pond
	216-B-3C Expansion Pond

The primary purpose of the 200-BP-11 Operable Unit field investigation will be to assess the extent of radionuclide and hazardous waste constituents in the soil beneath these units. The groundwater beneath the 200-BP-11 Operable Unit is currently planned to be addressed by the 200-BP-5 and 200-PO-1 groundwater operable unit work plans (or treatability studies) and therefore will not be covered under this work/closure plan.

All work conducted under this work/closure plan will conform to the conditions set forth in the Tri-Party Agreement and its amendments, signed by the Washington Department of Ecology (Ecology), the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy (DOE). In accordance with the Tri-Party Agreement, relevant EPA guidance documents were consulted in the preparation of the work plan, including those listed below.

- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988a)

- *Data Quality Objectives for Remedial Response Activities* (EPA 1987)

- *Interim Guidance and Specification for Preparing Quality Assurance Project Plans* (EPA 1983a)

- *Superfund Exposure Assessment Manual* (EPA 1988b)

- *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A, Interim Final* (EPA 1989a)

- *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (EPA 1989b)

- *EPA Region 10 Supplemental Risk Assessment Guidance for Superfund* (EPA 1991)

- *Data Quality Objectives Process for Superfund, Interim Final Guidance* (EPA 1993)

- *Hanford Site Baseline Risk Assessment Methodology* (DOE-RL 1993e).

Additionally, this document will fulfill the RCRA requirements for closure of TSD units per the Washington Administrative Code (WAC), Section 173-303-610 (Closure and Postclosure).

The remainder of this section discusses issues influencing the coordination of a RCRA past-practice work plan and RCRA TSD closure/postclosure plan, supporting documents, objectives, and organization of the work/closure plan.

1.1 RCRA PAST-PRACTICE WORK PLAN AND RCRA TSD CLOSURE/POSTCLOSURE PLAN COORDINATION

The coordination of a RCRA past-practice work plan and a RCRA TSD closure/postclosure plan involves resolving several issues prior to formulating a strategy for the corrective measures study (CMS). These include terminology, document format, and sampling strategy, and are discussed further in the following sections.

1.1.1 Terminology

Table 1-1 lists the terminology related to corrective actions for RCRA past-practice, RCRA TSD, and CERCLA past-practice waste management units. This document will employ the terminology for RCRA past-practice waste management units. It should be recognized that RCRA closure/postclosure plans do not currently utilize nomenclature for the many phases of the corrective investigation process. For example, closure/postclosure plans do not refer to the characterization activities as a RCRA facility investigation (RFI). Additionally, RCRA closure/postclosure plans do not currently employ terminology such as risk assessments, feasibility studies, or interim remedial measures (IRMs).

The terminology and acronyms listed in Table 1-1 will be used frequently throughout this document and should therefore be well understood.

1.1.2 Document Format

The document formats for RCRA past-practice work plans and RCRA TSD closure/postclosure plans at the Hanford Site are somewhat different.

A RCRA TSD closure/postclosure plan is a single document that describes all corrective measure activities and alternatives associated with the TSD unit. One problem with the closure/postclosure plan format is that the document is written prior to soil sampling and evaluation, and therefore must provide an array of alternatives for the many different contamination scenarios that may be encountered. Additionally, the closure/postclosure plan must be revised after analytical data are obtained. In the revision, comparisons are made between the concentrations of the constituents of concern and the cleanup levels.

On the other hand, RCRA past-practice activities utilize multiple documents to plan sampling and analysis, evaluate data, study alternatives, and finally reach the remedial action for the operable unit. The documents of the past-practice process include a work plan, qualitative risk assessment (QRA), limited field investigation (LFI) report, CMS, IRM plan, and an operable unit record of decision (ROD). A dilemma with this format is that the many documents have different numbers and must therefore be cross referenced.

This work/closure plan will employ a format similar to the past-practice format, but will use a "volumed" approach. That is, future related documents (e.g., LFI report) will maintain the same document number but will have a different volume number. This format will fulfill the current requirements for both the RCRA past-practice work plan and the RCRA closure/postclosure plan. Table 1-1 provides a correlation between the sections of a closure/postclosure plan and the past-practice documents. Additionally, the table provides the volume of this document for which the coinciding part of a closure/postclosure plan will appear. Following is the proposed method for assembling the volumes of this document.

- *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 1, "Field Investigation and Sampling Strategy"

- *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 2, "Risk Assessment and Field Investigation Report"

- *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 3, "Corrective Measures Study"

- *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 4, "Corrective Measures Plan"

- *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 5, "Corrective Measures Design Report."

The schedule in Chapter 6.0 provides the timeline for the above volumes. Volume 1 will be transmitted to the regulators by September 1994 in accordance with Tri-Party Agreement milestone M-13-07. After regulator comments are resolved, Volume 1 will go to the public for a 30-day review. Volumes 2 and 3 will be submitted to Ecology and EPA, but will not go to the public for review. The public review cycle for these volumes will be achieved during the 60-day review of the corrective measures plan (CMP) (Volume 4). The approval of Volume 4 by the regulators and public will be regarded as the completion of the closure/postclosure plan for the 216-B-3 Main Pond TSD unit. After approval of the CMP, the Hanford Facility Site-Wide Permit will be modified to incorporate pertinent material provided in Volumes 1 through 4. The corrective measures design report (Volume 5) will be included with this work/closure plan to retain the grouping of relevant corrective measures information for the operable unit and TSD unit.

1.1.3 Sampling Strategy

There is a major difference between the sampling approach used at RCRA past-practice and RCRA TSD waste management units. Past-practice waste management units utilize an analogous site concept to characterize units. This concept is described in detail in the *Hanford Past-Practice Strategy* (DOE-RL 1991b) and Section 8.3 of the *B Plant Source Aggregate Area Management Study Report* (DOE-RL 1993c). The basis of the concept is to locate the highest levels of contamination and apply those levels to analogous (i.e., similar structure and disposal practices) waste sites and evaluate the feasibility of IRMs for the units. Another purpose of past-practice sampling is to provide data to support the conceptual model as discussed in Section 4.2.

RCRA TSD waste management units do not employ the analogous site concept. The objective of RCRA TSD sampling and analysis is to make final, not interim, remedial decisions. Therefore, RCRA TSD sampling and analysis is designed to be more extensive to support these final decisions.

This work/closure plan proposes a sampling strategy that will fulfill both the past-practice and TSD unit sampling needs. The sampling approach will provide a rigorous sampling design on the TSD portions of the operable unit and a somewhat less-stringent field investigation on the past-practice waste units. In both cases, the sampling events are targeted towards finding the highest levels of contamination based on process knowledge and field screening instruments. However, the sampling approach for TSD units will strive to provide a more complete representation of site conditions, not just contaminant maximums. Additionally, the data quality objectives (DQOs) and sampling strategy discussed in Chapters 4.0 and 5.0, respectively, are targeted toward making final corrective measure decisions for the 200-BP-11 Operable Unit, including the 216-B-3 Main Pond TSD unit. That is, the field investigation is expected to lead directly to a CMP, thus bypassing an IRM plan (see Table 1-1).

1.2 SUPPORTING DOCUMENTS

The primary supporting documents for this work/closure plan are the *B Plant Source Aggregate Area Management Study Report* (DOE-RL 1993c), the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a), and the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b). Additionally, the *PUREX Source Aggregate Area Management Study Report* (DOE-RL 1993f) was reviewed with respect to contaminants of concern for the operable unit. Detailed information regarding source data, background information, physical setting, known and suspected contamination, conceptual models, and past-practice strategies is provided in these documents. The B Plant Aggregate Area Management Study (AAMS) Report (DOE-RL 1993c) also includes a health and safety plan and a project management plan (DOE-RL 1993c, Appendices B and C, respectively). These documents are referenced throughout this plan to reduce excessive material and to create a concise work/closure plan.

The B Plant Source AAMS Report compiled and evaluated existing data and information to support the *Hanford Past-Practice Strategy* (DOE-RL 1991b) decision-making process. A primary task in this process was to assess each waste management unit and unplanned release within the aggregate area to determine the most expeditious path for remediation within the statutory requirements of CERCLA and RCRA. A data evaluation process has been established that uses the existing data to develop preliminary recommendations on the appropriate remediation process path for each waste management unit. This data evaluation process is a refinement of the *Hanford Past-Practice Strategy* (Figure 1-3) and establishes criteria for selecting appropriate Hanford past-practice strategy paths (expedited response actions [ERAs], IRMs, LFIs, and final remedy selection) for individual waste management unit and unplanned releases within the 200 Areas.

The *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a) provides the closure strategy for the five RCRA TSD waste management units within the operable unit including the rationale for the splitting of the TSD units into two groups (i.e., two Part A Permits). Additionally, the pond system closure/postclosure plan provides comprehensive descriptions and background for the TSD waste management units. In support of the pond system closure/postclosure plan, a significant number of surface and subsurface samples were taken from the operable unit. The *216-B-3 Expansion Ponds Closure Plan* (Appendices C, D, and E; DOE-RL 1993b) provides the analytical results from the samples.

The Tri-Party Agreement is also a key supporting document. The Tri-Party Agreement provides a Community Relations Plan for the Hanford Site. The Tri-Party Agreement also requires that the cleanup programs at the Hanford Site integrate the requirements of CERCLA (40 CFR 300), RCRA (40 CFR 265, Subpart S), and Washington State's dangerous waste program (the state's RCRA-equivalent, WAC 173-303, "Dangerous Waste Regulations").

The EPA maintains authority for CERCLA, and Ecology implements RCRA under the authority of the state's dangerous waste program. Ecology also has authorization to implement the EPA's radioactive mixed waste program. However, Ecology does not yet have authority to implement the most recent amendments to RCRA, the Hazardous and Solid Waste Amendments (HSWA); this authority remains under EPA. Pursuant to the Tri-Party Agreement, the 200-BP-11 Operable Unit is subject to RCRA corrective measures authority with Ecology as the lead agency.

1.3 PURPOSE, SCOPE, AND OBJECTIVES

The purpose of this work/closure plan and attached or referenced supporting project plans is to establish the objectives, tasks, and schedule for conducting the RCRA Facility Investigation/ Corrective Measures Study (RFI/CMS) for the 200-BP-11 Operable Unit. Additionally, this work/closure plan establishes the objectives, tasks, and schedule for closure of the RCRA TSD waste management units in the operable unit not addressed in the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b), i.e., the 216-B-3 Main Pond and 216-B-3-3 Ditch. The field investigation strategy developed (Chapters 4.0 and 5.0) will provide the basis for the identification of corrective measure requirements (CMRs) to support the CMS. Following the CMS, a CMP will be prepared that will lead to a modification in the Hanford Facility Site-Wide Permit.

The objective of the work/closure plan is to develop a program to investigate the extent of dangerous and radioactive constituents in the surface and subsurface soils in the 200-BP-11 Operable Unit. The investigation will support the conceptual model developed in Section 4.2 and will provide data to evaluate and implement corrective measures as needed to ensure the protection of human health and the environment. These corrective measures are discussed in detail in Chapter 7.0 of the B Plant AAMS Report (DOE-RL 1993c). The predominant areas under investigation are two RCRA past-practice units, the 216-B-3-1 and 216-B-3-2 Ditches, and two RCRA TSD units, the 216-B-3 Main Pond/216-B-3-3 Ditch and the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. The Expansion Ponds are currently being evaluated and "clean closed" for dangerous waste via the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b) and, therefore, no further assessment for dangerous constituents is needed for the expansion ponds. However, the expansion ponds will be further assessed for radionuclide contamination with the operable unit.

Note that there are an additional three TSD units in the operable unit that will not be addressed by this work/closure plan: the Liquid Effluent Retention Facility (LERF), Effluent Treatment Facility (ETF), and Purgewater Storage Tanks (see Plate 1). These units are RCRA TSD units that operate under individual Form 3's (Appendix B) as specified in the Hanford Part A Permit and will be closed at a later date.

As stated in the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a), all waste management units, including TSD units within an operable unit, generally will undergo investigation and remediation (closure) at the same time. Following are the remediation and closure goals for the 200-BP-11 Operable Unit.

- Clean close the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds in accordance with the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b).

- To support closure of the 216-B-3-3 Ditch and 216-B-3 Main Pond TSD unit, discontinue effluent discharge to the 216-B-3-3 Ditch and 216-B-3 Main Pond. (This action was performed in the spring of 1994.)

- As an interim measure, stabilize (cover with clean soil) the inactive ditch and pond to prevent dispersal of potential radionuclide contamination from the surface soil and sediments.

- Obtain samples from surface soil, boreholes, and test pits or auger holes, and analyze the samples to characterize the operable unit surface and vadose zone for radiological and chemical contaminants.

- Assess the 216-B-3-3 Ditch and 216-B-3 Main Pond TSD unit for RCRA clean closure (WAC 173-303-610) after initial field investigation. Clean close as used in this context means that no dangerous waste or dangerous waste-contaminated soil, structures, or equipment will remain onsite that pose a threat to human health or the environment. Clean closure does not include radioactive contamination.

- Propose interim/final corrective measures for the operable unit based on RCRA past-practice and/or RCRA TSD CMRs.

1.4 200-BP-11 OPERABLE UNIT WORK/CLOSURE PLAN AND LATER ACTIVITIES

Figure 1-4 depicts the steps leading toward remediation of waste management units at the Hanford Site according to the *Hanford Past-Practice Strategy* (DOE-RL 1991b). The process is shown commencing with the AAMS report and finishing with the implementation of corrective measures. The following discussion describes each of the steps.

(1) The remediation process is shown beginning with the AAMS report. The AAMS report includes the analysis of existing data, a preliminary conceptual model, identification of data needs, and evaluation of data adequacy. Therefore, the AAMS report fulfills the historical search (preliminary assessment/site assessment) needed for the operable unit. From the data collection and evaluation, the AAMS report makes recommendations for ERAs, IRMs, and final remedy selection paths. In cases where there are inadequate data, an LFI is recommended so that a determination for an IRM or final remedy selection can be made. This is the pathway identified for the 200-BP-11 Operable Unit.

Figure 1-4 shows the decision point where the determination is made of the sufficiency of data for a corrective measure (or IRM). In the AAMS report process, this determination was made for certain waste management units. Obtaining the necessary information to make this determination is the subject of the *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*, Volume 1.

(2) Field Investigation Work/Closure Plan

The purpose of the field investigation work plan is to provide the rationale and direction for collecting information at waste management units designated for LFIs. As will be described in later sections of this work/closure plan, strategies are developed for acquiring data at representative (analogous) waste management units that are suspected to contain higher levels of contamination than other waste management units. These strategies will aid in supporting the conceptual model (Section 4.2) envisioned for the operable unit. The data obtained from these representative units will aid in the characterization of other waste management units.

A DQO process was performed for the operable unit (see Section 4.2) including the 216-B-3-3 Ditch/216-B-3 Main Pond RCRA TSD unit. During the process, several agreements were reached among Ecology, EPA, and the DOE, Richland Operations Office (DOE-RL) with respect to the field investigation and are provided in Appendix C. These agreements are incorporated into this work/closure plan and are intended to provide sufficient data to make final corrective measure decisions for the operable unit.

(3) Field Investigation

The primary goals of the field investigation described in this work/closure plan are to sufficiently define and quantify the conceptual model to support the performance of QRAs that are used to aid in the selection of corrective measures for both the RCRA past-practice and RCRA TSD waste management units. This will involve identifying maximum chemical and radioactive contaminant concentrations, vertical distributions and, to a lesser extent, horizontal distributions. The data collected during the field investigation should be of sufficient quality for use in determining the final corrective measures for past-practice units and must be of sufficient quality for use in determining final corrective measures for the TSD units.

(4) Qualitative/Quantitative Risk Assessment

QRA requirements stem from the Hanford past-practice investigation strategy (DOE-RL 1991b) and the CERCLA process. While QRAs are not necessary for RCRA TSD closure requirements and the corrective action regulations, a component of these is to meet objectives similar to QRA objectives (i.e., risk-based cleanup goals under WAC 173-340, "The Model Toxics Control Act Cleanup Regulations;" protection of human health and the environment).

A requirement for the QRA is that sufficient information be known from which a defensible decision to perform a corrective measure can be made. The QRA will be performed to determine if contaminant concentrations are high enough and exposure pathways exist such that measures are needed to reduce a potential exposure pathway. Chemical and radionuclide concentration data collected during the field investigation will be used in the QRA, and the QRA will be used to aid in corrective measure selection.

When data sufficiency is adequate to perform the risk assessment and support the identification of CMRs, a CMS will be performed.

(5) Corrective Measures Study

A CMS will be conducted to identify a suitable remediation technology for each waste management unit or group of similar waste management units. The CMS is conducted to provide a comprehensive evaluation of technologies. The CMS concludes with a report describing the evaluation and selection of the recommended corrective measure.

(6) Interim Remedial Measure/Corrective Measures Plan

The IRM plan will succeed the CMS and QRA when a CMS is unnecessary. (This is the case for the interim stabilization activities described in Chapter 2.0.) The IRM plan describes the selected technology and its implementation. The IRM may combine similar actions at waste management units or may be developed for a single waste management unit. In either case, every effort should be made to ensure that the IRM will perform synergistically with the final corrective measure for the waste management unit(s).

The CMP provides the rationale for selection of final corrective measures for the operable unit. The CMP will be utilized when the waste management units are effectively characterized for dangerous and radioactive waste and a CMS and QRA have been completed. A CMP (in lieu of the IRM plan) is the anticipated course to be taken for the 200-BP-11 Operable Unit.

(7) Hanford Facility Site-Wide Permit

The Hanford Facility Site-Wide Permit is the legal document describing the corrective measures to be taken at the RCRA past-practice and RCRA TSD units. The permit will be modified after review, comment, and approval of the CMP by the overseeing agencies and the public. The Hanford Facility Site-Wide Permit describes the context and plan for conducting the corrective measures. Following issuance of the Hanford Facility Site-Wide Permit modification, the corrective measures will be implemented or, if agreed to by the regulators, corrective measures may commence upon public approval of the CMP.

(8) Corrective Measures Implementation

The corrective measures will be implemented according to the description and schedule indicated in the Hanford Facility Site-Wide Permit or, if agreed to by the regulators, after public approval of the CMP. The implementation process will include preparation of preliminary and final design documents and other supporting plans. The corrective measures technology will then be implemented. The technology will be assessed to ensure that the corrective measures have been successful. In many cases, this assessment will be via institutional controls and monitoring.

1.5 ORGANIZATION OF THE WORK/CLOSURE PLAN

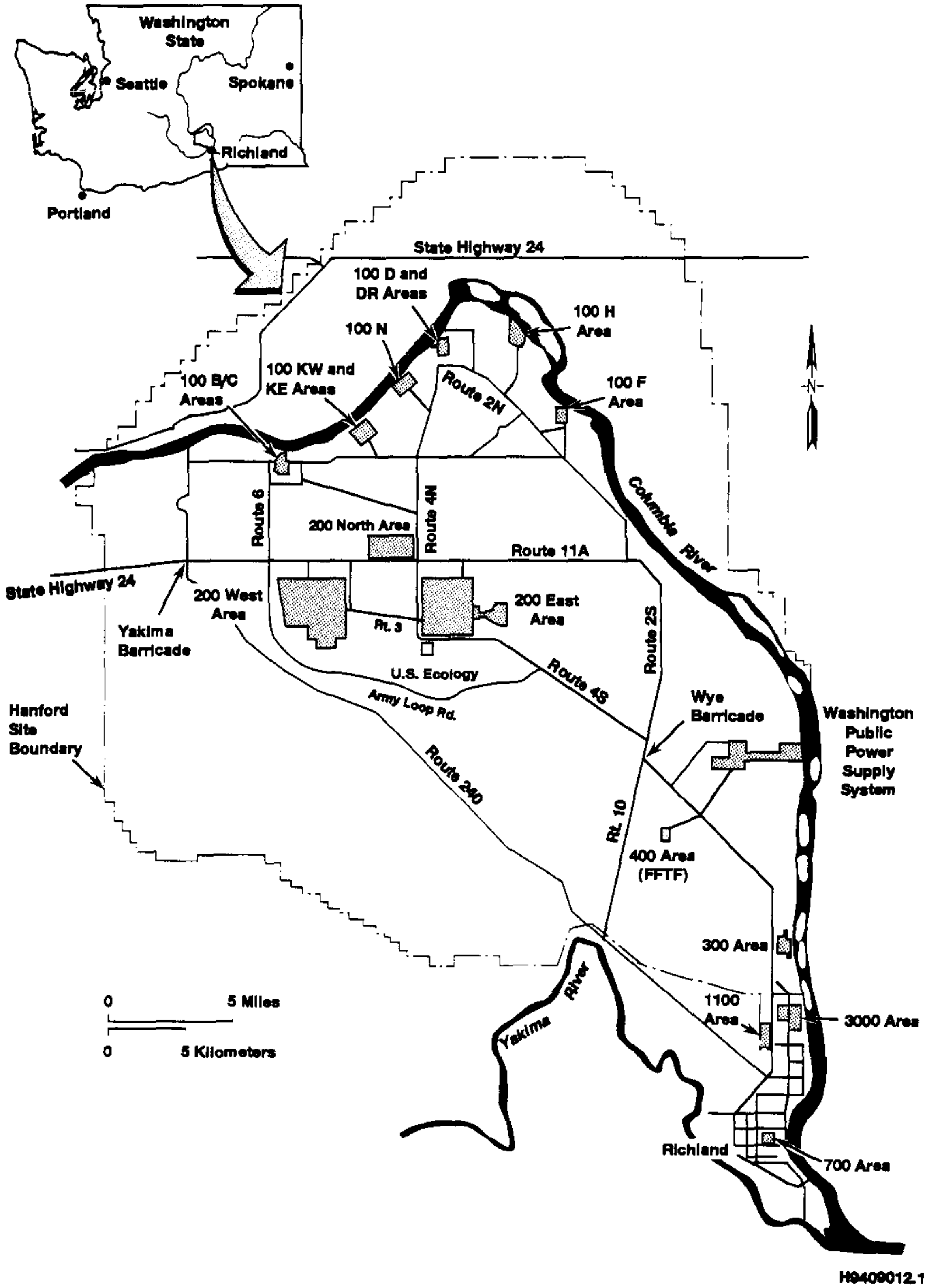
Volume 1 of this work/closure plan is composed of seven chapters, including this introduction.

Chapters 2.0 and 3.0 predominately summarize, or refer to, information provided in the B Plant AAMS Report (DOE-RL 1993c) and the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a). Chapter 2.0 provides the 200-BP-11 Operable Unit history and description, including topics such as physical characteristics, clean closure of expansion ponds, and interim stabilization activities. Chapter 3.0 provides an initial evaluation (which primarily discusses known and suspected contamination), potential CMRs, and identifies preliminary corrective measure objectives. Chapter 4.0 provides the work plan rationale including DQOs. Chapter 5.0 provides the RFI/CMS tasks. Key topics include the field investigation, the work breakdown structure, interim corrective measures and implementation, and the CMS report. Chapter 6.0 presents the project schedule for the work/closure plan activities, and Chapter 7.0 lists the references. Appendix A contains the Quality Assurance Project Plan (QAPjP), Appendix B the RCRA TSD Form 3's for the Hanford Site Part A Permit, and Appendix C the DQO agreements.

1.6 QUALITY ASSURANCE

The *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan* and its supporting project plans have been developed to meet specific EPA guidelines for format and structure, within the overall quality assurance (QA) program structure mandated by DOE-RL) for all activities at the Hanford Site. These DOE mandates include DOE Order 5700.6C, *Quality Assurance* (DOE 1991), and other QA guidance documents as applicable, e.g. the Hanford Analytical Services Quality Assurance Plan (HASQAP) (DOE-RL 1994). The 200-BP-11 Operable Unit QAPjP (Appendix A) supports the field sampling program described in the RFI/CMS Tasks (Chapter 5.0). It defines the specific means that will be used to ensure that the sampling and analytical data obtained as part of the field investigation will effectively support the purposes of the investigation. As required by the Bechtel Hanford, Inc. (BHI) QA program plan for RFI/CMS activities and the Tri-Party Agreement (Ecology et al. 1994), the structure and content of the QAPjP are based on *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA 1983a). Where required, the QAPjP invokes appropriate procedural controls selected from those listed in the BHI QA program plan for RFI/CMS activities or developed to accommodate the unique needs of this investigation.

Figure 1-1. Hanford Site Map.



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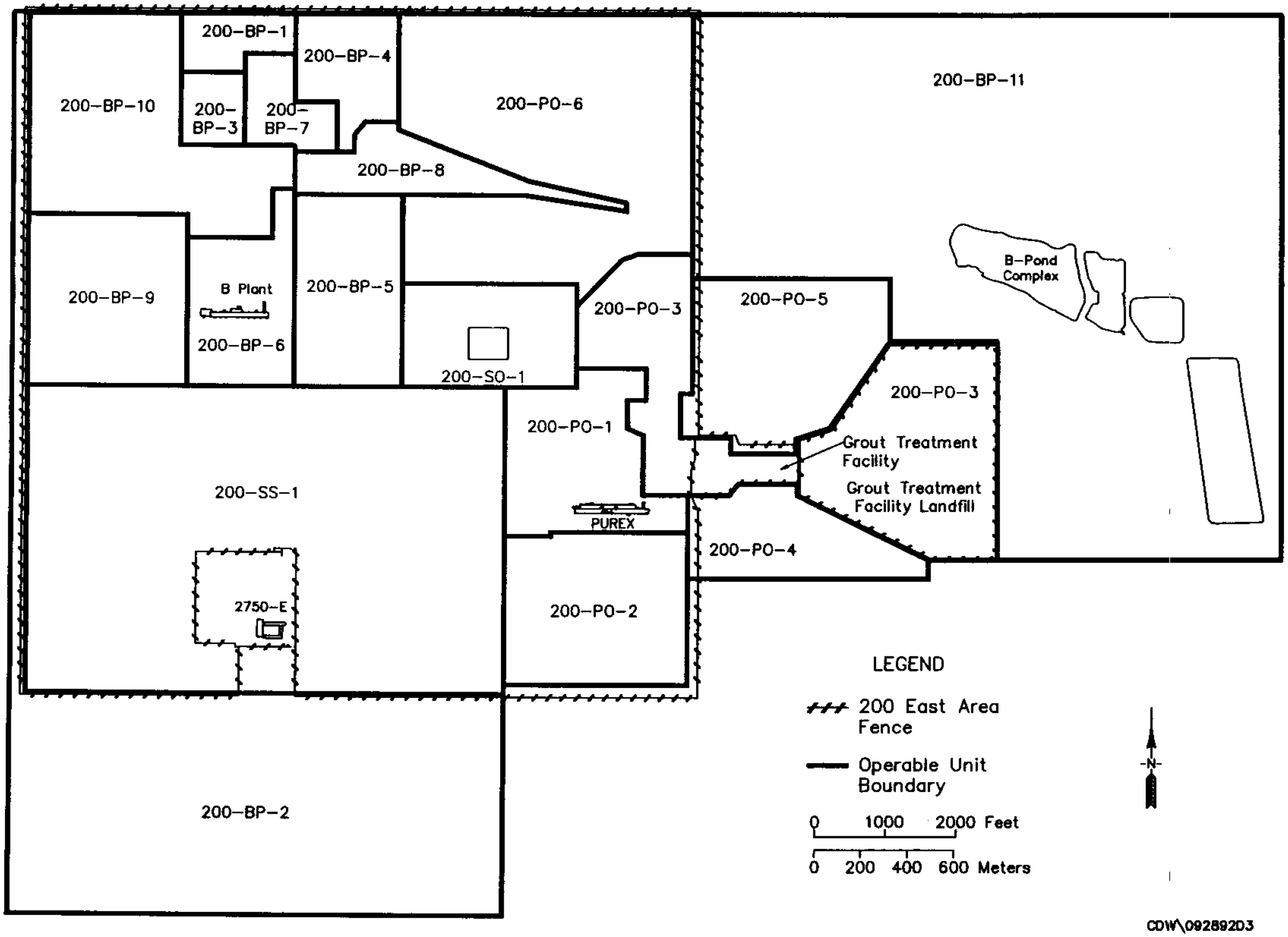

Figure 1-2. Source Operable Units in the 200 East Area.

Hanford Past Practice RI/FS (RFI/CMS) Process

The process is defined as a combination of interim cleanup actions (involving concurrent characterization), field investigations for final remedy selection where interim actions are not clearly justified, and feasibility/treatability studies.

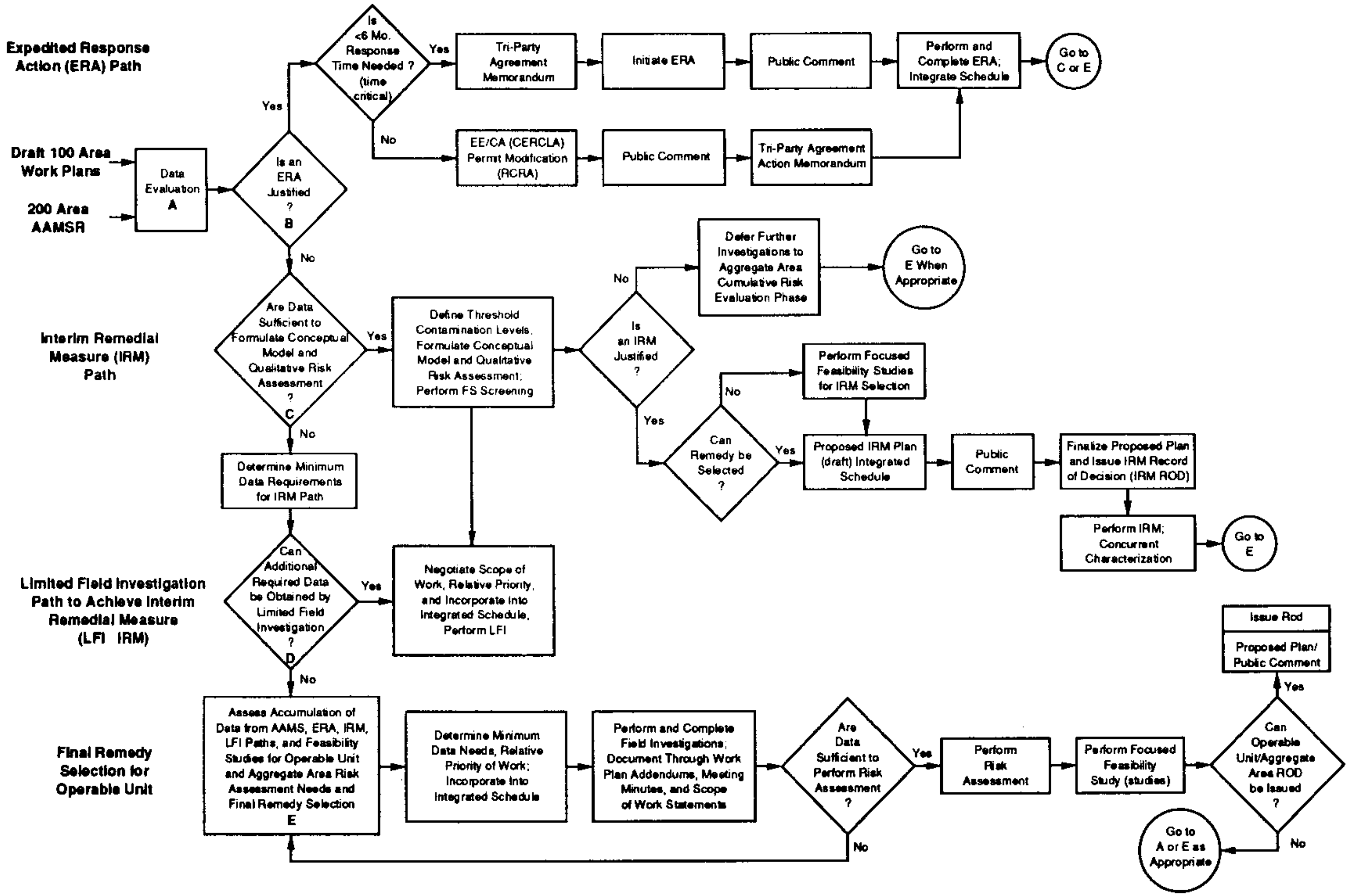

Figure 1-3. Hanford Past-Practice Strategy Flowchart (DOE-RL 1991b).

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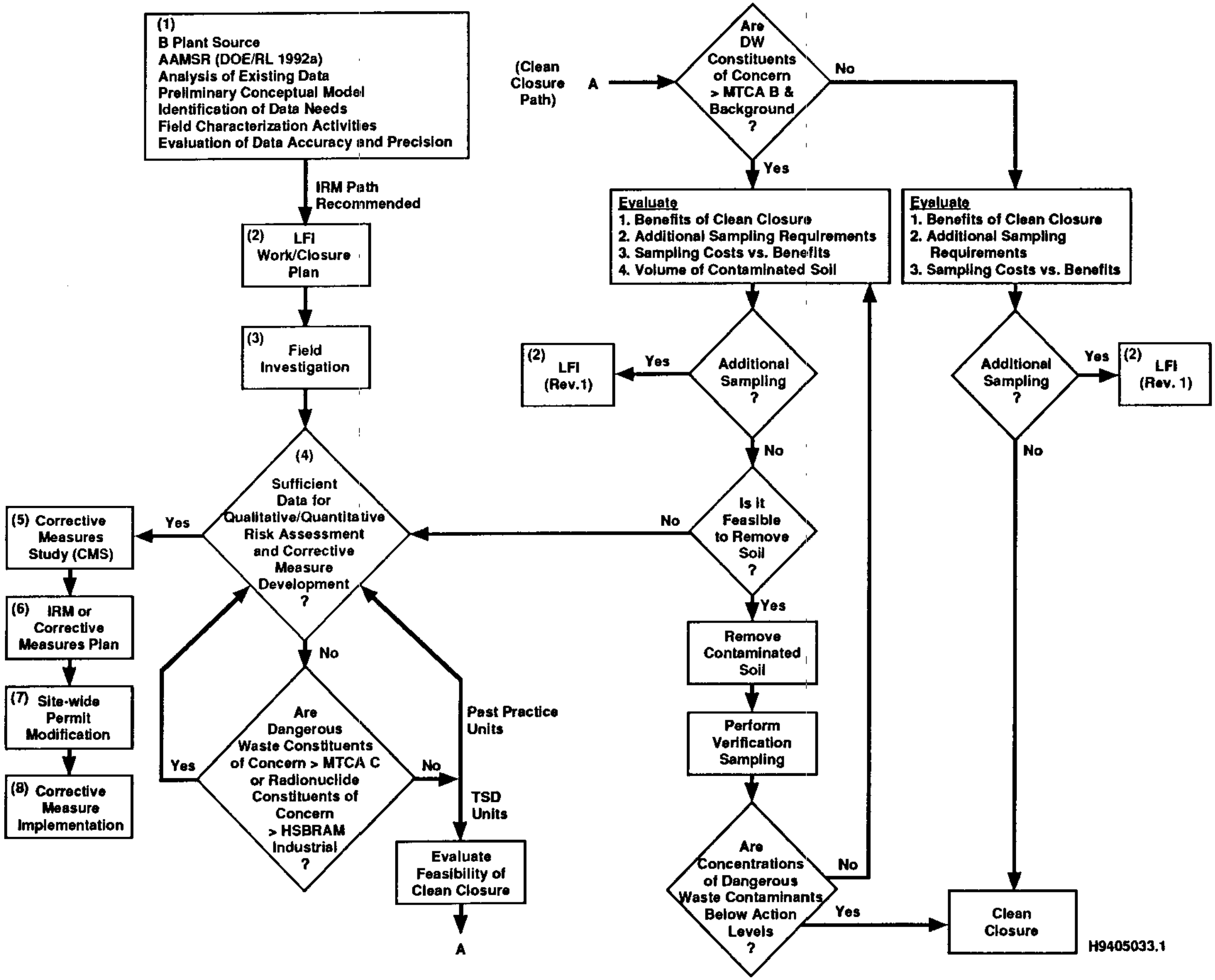

Figure 1-4. 200-BP-11 Operable Unit Work/Closure Plan Interrelationships.

Table 1-1. The Correlation Between RCRA TSD, RCRA Past-Practice, and CERCLA Past-Practice Processes and Terminology. (sheet 1 of 2)

Objective	RCRA TSD Closure/ Postclosure Plan Sections and Titles[a]	RCRA Past-Practice Work Plan	CERCLA Past-Practice Work Plan
1. Identify Releases Needing Further Investigation[b]	RCRA TSD unit Form 3	RCRA Facility Assessment (RFA)[b]	Preliminary Assessment/Site Investigation (PA/SI)[b]
2. Characterize Nature, Extent, and Rate of Release[b]	Section 2.0, "Facility Description and Location Information;" Section 3.0, "Process Information;" Section 4.0, "Waste Characteristics"	RCRA Facility Investigation (RFI)[b] (Volume 1)	Remedial Investigation (RI)[b]
3. Further Characterize Contaminant Constituents and Concentrations	Section 7.0, "Closure Activities"	Field Investigation and Sampling Strategy Work Plan (Volume 1)	Limited Field Investigation (LFI) and Sampling Strategy Work Plan
4. Report Extent and Risk of Contamination	N/A	Field Investigation and Risk Assessment Report (Volume 2)	Field Investigation and Risk Assessment Report
5. Evaluate Alternatives and Identify Preferred Remedy[b]	Section 6.0, "Closure Performance Standards;" Section 7.4, "Closure Requirements for Landfills"	Corrective Measures Study (CMS)[b]	Feasibility Study (FS)[b]
6. Determine Potential Government, State, and/or Local Regulations and Requirements	Section 6.0, "Closure Performance Standards;" Section 7.4, "Closure Requirements for Landfills"	Corrective Measure Requirements (CMR) (Volume 3)	Applicable and/or Relevant and Appropriate Requirements (ARAR)
7. Extensive Evaluation of Selected Remedy	Section 6.0, "Closure Performance Standards;" Section 7.4, "Closure Requirements for Landfills"	Focused or Final Corrective Measures Study (CMS) (Volume 3)	Focused or Final Feasibility Study (FS)
8. Expedite Stabilization and/or Cleanup of Contamination	N/A	Expedited Response Action (ERA)	Expedited Response Action (ERA)

Table 1-1. The Correlation Between RCRA TSD, RCRA Past-Practice, and CERCLA Past-Practice Processes and Terminology. (sheet 2 of 2)

Objective	RCRA TSD Closure/ Postclosure Plan Sections and Titles[a]	RCRA Past-Practice Work Plan	CERCLA Past-Practice Work Plan
9. Interim Stabilize and/or Cleanup Contamination	Section 7.0, "Closure Activities"	Interim Remedial Measure (IRM)	Interim Remedial Measure (IRM)
10. Propose Method for Stabilization and/or Cleanup of Contamination	Section 7.0, "Closure Activities"	Proposed IRM Plan	Proposed IRM Plan
11. Approve Stabilization and/or Cleanup Method	Notice of Deficiency (NOD) Cycle	IRM Record of Decision (ROD)	IRM Record of Decision (ROD)
12. Design Approved Stabilization and/or Cleanup Method	Section 7.0, "Closure Activities"	IRM Design Report	IRM Design Report
13. Realize Stabilization and/or Cleanup Method	Section 7.0, "Closure Activities;" Section 8.0, "Postclosure Plans"	IRM Implementation	IRM Implementation
14. Propose Final Remedy Selection (FRS)[b]	Section 5.0, "Groundwater Monitoring;" Section 7.0, "Closure Activities;" Section 8.0, "Postclosure Plan" Draft RCRA Site-Wide Permit Modification	Corrective Measures Plan (CMP); Draft Permit Modification[b] (Volume 4)	Remedial Action Plan[b]
15. Public Participation[b]	Public Comment	Public Comment[b]	Public Comment[b]
16. Authorize Selected Remedy[b]	Modify RCRA Site-Wide Permit	Modify RCRA Site-Wide Permit[b]	Remedial Action (or operable unit) ROD[b]
17. Design Chosen Remedy[b]	N/A	Corrective Measures Design Report (Volume 5)	Remedial Action Design (RD) Report[b]
18. Implement Chosen Remedy[b]	Site Clean Closure or Cap as Landfill	Corrective Measures Implementation (CMI)[b]	Remedial Action (RA) Implementation[b]

[a]Sections and titles acquired from the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b).
[b]Tri-Party Agreement, Table 7-2 (Ecology et al. 1994).

2.0 200-BP-11 OPERABLE UNIT DESCRIPTION AND HISTORY

This chapter provides a summary of the history of the 200-BP-11 Operable Unit and discussion regarding structures to be evaluated during the operable unit RFI. Section 2.1 summarizes the waste management units descriptions from the *B Plant Source Aggregate Area Management Study Report* (DOE-RL 1993c) and provides current information regarding the units. Section 2.2 discusses the RCRA TSD permitting history in the operable unit. Pipelines, structures and fixtures, and piezometers are discussed in Sections 2.3, 2.4, and 2.5, respectively. Interim stabilization activities for the 216-B-3 Main Pond and 216-B-3-3 Ditch are summarized in Section 2.6, and a summary of the physical setting of the operable unit, including meteorology and geology, is presented in Section 2.7.

2.1 WASTE MANAGEMENT UNIT DESCRIPTIONS

Waste management units within the 200-BP-11 Operable Unit are surface impoundments that were designed to receive effluents generated by 200 East Area operations, including those of the Plutonium/Uranium Extraction (PUREX) Plant and B Plant. Waste management units include the 216-B-3 Main Pond; 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds; 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches; 216-E-28 Contingency Pond; and Unplanned Releases UN-200-E-14 and UN-200-E-92. The physical characteristics of the waste management units are provided in Table 2-1, and the locations are shown on Plate 1. The operational history and key events for the waste management units are provided on a timeline in Figure 2-1. Complete waste management unit descriptions are provided in Section 2.3 of the B Plant Aggregate Area Management Study (AAMS) Report (DOE-RL 1993c). A historical summary of the waste management units follows.

2.1.1 The 216-B-3 Main Pond and 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches

The 216-B-3 Main Pond, in service from 1945 to 1994, was located in a natural topographic depression. From 1945 through 1964, waste water was discharged to the 216-B-3 Main Pond via the unlined, earthen 216-B-3-1 Ditch. Until Unplanned Release UPR-200-E-34 occurred in 1964, the main pond and terminal portion of the ditch formed a swampy surface area that varied in size from about 7.6 to 18.4 hectares (19 to 46 acres). This variation is size was due to fluctuations in effluent discharges. As a result of the release, bentonite was placed in the main pond to diminish the transport of contamination. The method of placement and amount of bentonite used is not known.

In 1955, the 216-A-29 Ditch was placed in service to receive PUREX Plant chemical sewer waste water. The 216-A-29 Ditch is located in the 200-P0-5 Operable Unit, which lies to the southwest of 200-BP-11 (see Figure 1-2 and Plate 1). The 216-A-29 Ditch discharged directly into the 216-B-3-1 Ditch prior to an accidental release (UPR-200-E-34) of mixed fission products from the PUREX Plant in 1964. This release was discharged to the 216-B-3-1 Ditch via the PUREX Plant cooling water line (see Plate 1) rather than the 216-A-29 Ditch. After the release, the 216-B-3-1 Ditch was decommissioned and backfilled.

In 1971, corrective action to eliminate growth of radioactive plants was taken at the 216-B-3-1 Ditch. The work consisted of leveling and cleaning the ground of all foreign objects followed by placement of 10 cm (4 in.) of sand. Over the sand cushion, sheets of 10-mil-thick plastic [10 m

(32 ft) wide by 30 m (100 ft) long per sheet] were placed. The sheets were overlapped 0.6 m (2 ft) to provide an effective plant root barrier. The sheeting was covered with 46 cm (18 in.) of sand and topped with 10 cm (4 in.) of gravel to prevent surface erosion. The entire ditch was treated in this manner except the first 30 m (100 ft) at the head wall. At the eastern end of the ditch where the ditch had widened into a swamp, the treated area is approximately 30 m (100 ft) wide. The east end of the ditch is 32 ft (10 m) wide (Maxfield 1979).

The unlined, earthen 216-B-3-2 Ditch was excavated and put into service in July 1964 to replace the 216-B-3-1 Ditch. The 216-A-29 Ditch discharged into the 216-B-3-2 Ditch approximately 305 m (1,000 ft) west of the 216-B-3 Main Pond. The 216-B-3-2 Ditch was decommissioned and backfilled with soil in 1970 after an accidental release (UPR-200-E-138) of strontium-90 from B Plant. As a result of this release, the contaminated 216-B-3 Main Pond bank soil was consolidated into the pond, and the north, south, and west shorelines were diked with 0.9 m (3 ft) of sand and gravel. The contaminated weeds on the upper sides of the 216-B-3-2 Ditch were scraped into the bottom of the ditch. The portion of the ditch from the confluence of the 216-A-29 Ditch to approximately 91 m (300 ft) east of the headwall was backfilled full of clean dirt. The east end of the ditch from the 216-A-29 Ditch to the main pond was used as a depository for contaminated Russian thistle removed from the shoreline of the main pond. This portion of the ditch was then filled with clean dirt to within 0.6 m (2 ft) of grade level. A 10-mil-thick plastic sheet was then laid over the ditch and covered to grade level with clean soil and topped with gravel to reduce erosion.

The unlined, earthen 216-B-3-3 Ditch was excavated and put into service in September 1970 to replace the 216-B-3-2 Ditch, and the 216-A-29 Ditch was routed to discharge into the 216-B-3-3 Ditch approximately 457 m (1,500 ft) west of the inlet to the 216-B-3 Main Pond. A fiberglass-reinforced polyester flume and flowmeter were installed downstream from the 216-A-29 Ditch and 216-B-3-3 Ditch confluence. The 216-A-29 Ditch was removed from service and backfilled in 1991.

An area of approximately 1.7 hectares (4.1 acres) immediately west of the 216-B-3 Main Pond was diked during the 1970's to provide an overflow area for the 216-B-3 Main Pond. This overflow area, referred to as the overflow pond, was decommissioned and backfilled in 1985.

The 216-B-3 Main Pond and 216-B-3-3 Ditch were decommissioned and backfilled (Section 2.6) in 1994. The 216-B-3 Main Pond, just before decommissioning, covered a surface area of approximately 14 hectares (35 acres) and was between 0.6 m (2 ft) and 4 m (14 ft) deep. Historical records indicate that the surface area of the pond has varied from 8 hectares (19 acres) to 19 hectares (46 acres).

2.1.2 216-B-3A and 216-B-3B Expansion Ponds

The 216-B-3A and 216-B-3B Expansion Ponds (see Plate 1) were constructed to receive increased discharges that would result from restart of the PUREX Plant. The ponds were constructed using a cut-and-fill construction method over a 9-hectare (22-acre) surface area [4 hectares (11 acres) each]. Eight-millimeter polyethylene plastic was placed along the slope of the pond banks and covered with approximately 8 cm (3 in.) of pit run gravel. The plastic was extended approximately 0.9 m (3 ft) out onto the pond bottom and 0.6 m (2 ft) back from the top of the dike.

The 216-B-3A Expansion Pond was placed into service in October 1983. The pond was operated until January 1984, when the dike between the 216-B-3 Main Pond and 216-B-3B Expansion Pond failed at the connecting spillway. All discharge from the dike failure was contained in the 216-B-3B Expansion Pond, which had remained unused until this time.

In response to this incident, flow to the 216-B-3 Main Pond was reduced and the 216-B-3A and 216-B-3B Expansion Ponds were isolated. A trench, oriented north-south and approximately 182 m (600 ft) long, 9 m (30 ft) wide, and 2 m (5 ft) deep, was excavated into a permeable sand and gravel layer beneath the 216-B-3A Expansion Pond bottom to provide an area of increased infiltration. Discharge to the 216-B-3A Expansion Pond was resumed, but at a reduced rate, to contain flow and infiltration to the newly constructed trench.

The debris from the dike failure was removed from the 216-B-3B Expansion Pond, and a series of trenches were excavated in pond bottom to increase the infiltration rate. The excavated material was placed along the shores of the 216-B-3 Main Pond as diking.

The 216-B-3A and 216-B-3B Expansion Ponds were fully operational by June 1984. The 216-B-3B Expansion Pond was taken out of service in May 1985, and up to 2 m (7 ft) of material was excavated from the pond bottom, to a depth below the bottom of the trenches. The excavated material was placed as diking on the north shore of the 216-B-3 Main Pond. The 216-B-3B Expansion Pond has not been used since it was taken out of service in May 1985. The 216-B-3A Expansion Pond was decommissioned in 1994.

2.1.3 216-B-3C Expansion Pond

The 216-B-3C Expansion Pond was constructed in 1985 to accommodate increased flow resulting from the decommissioning of 216-A-25 Pond (Gable Mountain Pond, 200-IP-6 Operable Unit). The 216-B-3C Expansion Pond was constructed by excavating 2 m (6 ft) of soil over a 17-hectare (41-acre) surface area. Eight parallel north-south trenches, approximately 2 to 4 m (8 to 14 ft) wide and 1 m (4 ft) deep, were constructed in the pond bottom to increase infiltration. An east-west trench in the 216-B-3C Expansion Pond bottom connects the 216-B-354 spillway (see Plate 1) with the eight north-south trenches. The excavated material was placed in a spoil mound along the east and part of the north and south sides of the pond. The slopes of the pond were stabilized with 8 cm (3 in.) of 3- to 15-cm- (1- to 6-in.) size gravel. A gravel maintenance road was constructed along the edge of the pond.

2.1.4 216-E-28 Contingency Pond

The 216-E-28 Contingency Pond was constructed in 1987 north of the 216-B-3 Main Pond to provide emergency overflow capability for the 216-B-3 Main Pond. This unit has never been used and therefore does not pose a threat to human health or the environment.

2.1.5 Unplanned Releases

Six known unplanned releases have affected the 200-BP-11 Operable Unit and are discussed below in order of occurrence. Complete descriptions of these unplanned release are provided in the B Plant Source AAMS Report (DOE-RL 1993c). Two of the six unplanned releases (UN-200-E-14 and UN-200-E-92) are waste management units per the Tri-Party Agreement (see Plate 1), and two others (UPR-200-E-34 and UPR-200-E-51) are considered a part of the waste management units in which they occurred. The remaining two (UPR-200-E-32 and UPR-200-E-138) occurred in the 200-BP-8 Operable Unit and may have had an impact on the 200-BP-11 Operable Unit.

- Unplanned Release UN-200-E-14 occurred in 1958 when a dike failed on the east side of the 216-B-3 Main Pond. This release would contain the same potential contamination associated with the 216-B-3 Main Pond and therefore does not present additional contaminants of concern to the operable unit. Because this release occurred on the east side of the 216-B-3 Main Pond, it was incorporated into the 216-B-3A Expansion Pond and thus characterized as part of the Phase 1, 2, and 3 studies (Section 3.2).

- Unplanned Release UPR-200-E-32 occurred in November 1963 when about 5,000,000 L of water contaminated with about 30 Ci of cerium-144 and 0.05 Ci of strontium-90 was released to the 216-B-2-1 Ditch (200-BP-8 Operable Unit) (WHC 1991c). This release is likely to have affected the 216-B-3-1 Ditch and the 216-B-3 Main Pond (and overflow pond), but the extent of contamination that reached these units is not known.

- Unplanned Release UPR-200-E-34 occurred in June 1964 when a coil leak in the F-15 tank in the PUREX Plant contaminated the 216-B-3-1 Ditch and 216-B-3 Main Pond (and overflow pond) with approximately 2,500 Ci of mixed fission products. This release was a major source of radioactive contamination to the ditch and resulted in its decommissioning and backfilling. Also, as a result of this release, bentonite was placed in the main pond to diminish the transport of contamination. The method of placement and amount of bentonite used is not known.

- Unplanned Release UPR-200-E-138 occurred in March 1970 when about 1,000 Ci of strontium-90 was released from B Plant to the 216-B-2-2 Ditch (200-BP-8 Operable Unit). This release is likely to have contributed contamination to the 216-B-3-2 Ditch and 216-B-3 Main Pond (and overflow pond). The 216-B-2-2 and 216-B-3-2 Ditches were closed as a result of this release.

- Unplanned Release UPR-200-E-51 occurred in May 1977 when 51 kg of cadmium nitrate was released from the PUREX Plant to the chemical sewer, which dispersed to the 216-B-3-3 Ditch and 216-B-3 Main Pond (and overflow pond).

- Unplanned Release UN-200-E-92 was detected in September 1980 as a result of contaminated Russian thistle along the east perimeter fence. The contaminated thistle and soil was removed and disposed of at an excavation pit north of 216-A-24 Crib.

2.2 RCRA TSD PERMITTING HISTORY

There are currently five RCRA TSD units in the 200-BP-11 Operable Unit. These units are shown on Plate 1 and listed below.

- 216-B-3 Main Pond and 216-B-3-3 Ditch
- 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds
- LERF
- ETF
- Purgewater Storage Tanks.

The first two groups of waste management units are the TSD units under investigation in this work/closure plan. These units were previously grouped together and permitted as one TSD unit. Currently, they have interim status under separate Form 3's as discussed in Section 2.2.1. The latter three units and associated piping, structures, and fixtures are not part of the RFI for the operable unit and are discussed briefly in Section 2.2.2.

2.2.1 216-B-3-3 Main Pond, 216-B-3-3 Ditch, and 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds

As a result of dangerous waste discharges to the 216-B-3-3 Ditch and 216-B-3 Main Pond, a Form 3 (Rev. 0) to the RCRA Part A permit application was submitted to Ecology in 1986. Revision 1 of the Form 3 was submitted in August 1987, and Revision 2 was submitted in November 1987. The RCRA Part A permit application was submitted under the single Dangerous Waste Permit Identification Number, WA7890008967, issued to the Hanford Site by the EPA and Ecology. The permit application designates the 216-B-3 Pond System a surface impoundment, subject to RCRA regulations for TSD units.

Revision 3 of the Form 3 (see Appendix B) for the 216-B-3 Pond System was submitted in 1990 with the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a). The reasons for Revision 3 were twofold. First, new information was obtained that allowed for the development of a detailed chemical discharge history for the years 1983 to 1987. The last known reportable chemical discharge occurred in April 1987. Second, the chemical discharges were evaluated at the point of discharge into the environment. The chemical discharge history, which this Form 3 was based on, was from the PUREX Plant. Other facilities that discharged to the 216-B-3-3 Ditch and 216-B-3 Main Pond either did not have the potential to discharge dangerous waste or a record search [documented in the B Plant AAMS Report (DOE-RL 1993c)] did not reveal documentation of dangerous waste discharges. A summary of the potential chemical discharges to the waste management units is provided in Chapter 3.0.

The Form 3 consisting of the five 200-BP-11 RCRA TSD waste management units has been divided to separate the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds from the 216-B-3 Main Pond and 216-B-3-3 Ditch. These two Form 3's are provided in Appendix B. The division was made to allow for clean closure of the expansion ponds while allowing integration of closure activities for the 216-B-3 Main Pond and 216-B-3-3 Ditch with RCRA corrective action for the 200-BP-11 Operable Unit. Clean closure of the expansion ponds is being initiated to meet the Tri-Party Agreement Milestone M-17-10, "Cease all liquid discharges to hazardous land disposal units unless such units have been clean closed in accordance with RCRA" (Ecology et al. 1992). The date associated with this milestone is June 1995.

2.2.2 Liquid Effluent Retention Facility, Effluent Treatment Facility, and Purgewater Storage Tanks

The LERF, ETF, and Purgewater Storage Tanks are not under investigation as part of the 200-BP-11 Operable Unit because each operates under individual Form 3's in the Hanford Site Part A Permit and thus will be closed as separate entities within the 200-BP-11 Operable Unit. Short descriptions of the LERF, ETF, and Purgewater Storage Tanks are presented in their respective Form 3's provided in Appendix B.

The LERF is classified as a surface impoundment and is permitted in accordance with WAC 173-303-805, "Interim Status Permits." The Part B Permit Application is documented as DOE/RL-90-43, *Liquid Effluent Retention Facility Dangerous Waste Permit Application* (DOE-RL 1991c), and provides a complete description of the facility.

Construction began on the LERF in May 1990 and was completed in 1992. It was constructed under interim status expansion. The LERF is a retention basin consisting of four identical cells with primary and secondary composite liners, a leachate collection and removal system between the liners, and a floating cover. Each retention basin cell has a design capacity of 24,600 m^3 (6,500,000 gal) with a total capacity of 98,400 m^3 (26,000,000 gal). Currently, it is planned to use only three basins; the fourth basin will serve as a contingency basin.

The ETF is classified as a treatment facility and is permitted in accordance with WAC 173-303-805, "Interim Status Permits." The Part B Permit Application, DOE/RL-92-03, *Hanford Facility Dangerous Waste Permit Application, 200 Area Effluent Disposal Facility* (DOE-RL 1993d), provides a complete description of the unit.

Construction began on the ETF in March 1993, and the facility is expected to come online in October 1994. The facility will treat and store process condensate from the 242-A Evaporator via the LERF, and possibly other Hanford Facility waste that falls within the envelope of acceptable waste at the ETF. The treatment process includes filtration, pH adjustment, ultraviolet oxidation, hydrogen peroxide decomposition, degasification, reverse osmosis, ion exchange, effluent quality verification in tanks, evaporation, concentration, and thin film drying.

The Purgewater Storage Tanks are classified as a storage and treatment facility and is permitted in accordance with WAC 173-303-805, "Interim Status Permits." The Part A Permit Application, DOE/RL-88-21, *600 Area Purgewater Storage and Treatment Facility* (DOE-RL 1990b), provides a brief description of the facility. There is not a Part B permit application for the facility because it is operating under interim status.

The facility is composed of two 3,790-m^3 (1,000,000-gal) aboveground storage tanks, although it is permitted for six tanks. The purgewater units are used for interim storage and treatment of purgewater generated from the groundwater monitoring wells located throughout the Hanford Site. The purgewater from a groundwater monitoring well is transported by tank truck and pumped directly into the purgewater tanks. No external piping is associated with the facility. Treatment of the purgewater in the two 3,790-m^3 tanks is by solar evaporation.

2.3 PIPELINES

The pipelines within the 200-BP-11 Operable Unit are depicted in Figure 3-1 and Plate 1. The pipelines of concern for the operable unit RFI are the PUREX Cooling Water Line and the 216-B-3-2 Pipeline. All other pipelines are active and will be addressed during decommissioning of their respective facilities. These active pipelines include the 1.2-m (48-in.) corrugated metal pipe running to the 216-E-28 Contingency Pond; the 91-cm (36-in.) high-density polyethylene pipe running to the 216-B-3A Expansion Pond; the 76-cm (30-in.) high-density polyethylene pipe running to the 216-B-3B and 216-B-3C Expansion Ponds; and the pipeline feeding the Treated Effluent Disposal Facility (TEDF).

2.3.1 PUREX Cooling Water Line

The PUREX Cooling Water Line runs along the western edge of the 200-BP-11 Operable Unit. The segment of line to be assessed under the operable unit investigation is the inactive 1-m (42-in.) corrugated metal pipe running north of 216-E-28 Contingency Pond pipeline. This portion of the line was capped during the decommissioning of the 216-A-25 Pond (Gable Mountain Pond). The remainder of the pipe running south towards the PUREX Plant is 91-cm (36-in.) corrugated metal pipe and is active. This pipeline is expected to remain active for an unspecified duration.

2.3.2 216-B-3-2 Pipeline

The 216-B-3-2 Pipeline originates at B Plant and enters the west side of the 200-BP-11 Operable Unit. As shown on Plate 1, the pipeline separates into two lines about 400 m (1,310 ft) inside the 200 East Area perimeter fence. The northernmost pipe is a 60-cm (24-in.) vitrified clay pipe, is currently active, and will remain active for an unspecified duration. The southernmost pipe is a 53-cm (21-in.) vitrified clay pipe that discharged to the headwall of the 216-B-3-3 Ditch until the summer of 1994. This portion of the pipe will be capped as part of the interim stabilization activities for the 216-B-3-3 Ditch (see Section 2.6).

2.4 STRUCTURES AND FIXTURES

Structures and fixtures associated with the RFI for the 200-BP-11 Operable Unit are described in detail in the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a). The decommissioned structures and fixtures include the 216-B-351, 216-B-352, 216-B-353, and 216-B-354 overflow structures (spillways); the flume and flowmeter in the 216-B-3-3 Ditch; and the headwall of the 216-B-3-3 Ditch. The disposition of the structures and fixtures will be deferred until the field investigation report and CMS report are complete and will be provided in the CMP of this document (Volume 4). The headwall, flume, and flowmeter will be relocated during 216-B-3-3 Ditch interim stabilization activities (see Section 2.5).

The 216-B-351 spillway, in the dike between the 216-B-3 Main Pond and 216-B-3A Expansion Pond, was modified in 1983 to accommodate anticipated flow rates. The 60-cm- (24-in.) diameter culvert was replaced by a 91-cm- (36-in.) diameter, 12-gauge, spiral-corrugated, galvanized steel pipe. The fiberglass flume liner was removed, the concrete support walls were recast to widen the water flow area, and the flowmeter was removed.

A steel-reinforced concrete overflow control structure was constructed at the inlet to the pipe. The following structures were installed on the overflow control structure:

- Manually operated 3-m by 91-cm (42- by 36-in.) downward opening slide gate
- Trash guard constructed of 5-cm (2-in.) woven, diamond-mesh, galvanized wire
- Staff gauge to measure water surface elevation
- Metal grating over the surface to allow personnel access.

The 216-B-353 spillway was designed and constructed to replace the open ditch between the 216-B-3A and 216-B-3B Expansion Ponds. Shortly afterwards, the 216-B-352 spillway was constructed in the dike between the 216-B-3 Main Pond and 216-B-3A Expansion Pond. This spillway was constructed to handle the increased water flow resulting from the decommissioning of 216-A-25 Gable Mountain Pond. Both new spillways were constructed to the same design: two 76-cm- (30-in.) diameter corrugated metal pipes through the existing dikes, a steel-reinforced concrete overflow control structure, and a stilling basin. The following structures were installed on the overflow control structure:

- Control weir and manually operated, downward-opening slide gate for each 76-cm- (30-in.) diameter pipe

- Trash guard constructed of 5-cm (2-in.) diamond-mesh, 9-gauge, galvanized wire supported by a 5-cm- (2-in.) diameter pipe

- Staff gauge to measure water surface elevation

- Continuous 15-cm (6-in.) rubber dumbbell-type water stop

- Metal grating over the surface to allow personnel access.

Stilling basins were constructed at the spillway outfalls in the bottom of the ponds to control erosion. The basins were lined with erosion-control fabric and filled with riprap. The riprap extended beyond the basins and was placed over the pipes on the lower dike slopes.

The 216-B-354 spillway is similar in design to the 216-B-352 and -353 spillways and was constructed to convey water from the 216-B-3A Expansion Pond to the 216-B-3C Expansion Pond. The spillway consists of two 76-cm- (30-in.) diameter corrugated-metal pipes, a steel-reinforced concrete overflow control structure, and a stilling basin, and was designed for a maximum flow capacity of 75,708 L/min (20,000 gal/min). The two 76-cm- (30-in.) diameter pipes were installed by excavating a ditch approximately 290 m (950 ft) in length from the 216-B-3A Expansion Pond to the 216-B-3C Expansion Pond. A 10-cm- (4-in.) thick cushion of sand was placed under the pipe, and backfill was placed over the pipe to the existing grade.

2.5 PIEZOMETERS

In 1984, 22 piezometers were installed in a total of 10 boreholes in the earthen dikes impounding the 216-B-3 Main Pond and 216-B-3A Expansion Pond. The piezometer coordinates and depths are provided Table 2-1 of the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a), and construction detail is provided in Figure 2-21 of that document. The piezometers were installed in response to the dike failure that occurred between the 216-B-3A and 216-B-3B Expansion Ponds. By design, the 3- to 6-m- (10- to 20-ft) thick earthen dikes permitted a certain amount of saturated flow through and beneath the fill material from which they are constructed. The function of the piezometers was to monitor this saturated flow. Water level measurements were made at least once a month with an electric water level tape, but have not been taken since decommissioning of the ponds in February 1994.

The piezometers are no longer needed and will be abandoned as part of the interim stabilization activities (Section 2.6). The final disposition of the piezometers will be deferred until the CMS report is complete for the operable unit and will be provided in the CMP of this document (Volume 4).

2.6 INTERIM STABILIZATION ACTIVITIES AT THE 216-B-3 MAIN POND AND 216-B-3-3 DITCH

Interim stabilization (backfilling) activities were performed in 1994 for the 216-B-3 Main Pond and the 216-B-3-3 Ditch in consideration of their decommissioning. The major objective of interim stabilization is to fill the pond and ditch with clean soil to prevent the spread of potential radioactive contamination as the main pond sediment became exposed because the water has been rerouted to the 216-B-3B and 216-B-3C Expansion Ponds. The procedure for these activities is documented as DWP-R-026-00022, *Decommissioning and Interim Stabilization of the 216-B-3 Pond System* (WHC 1993a). The interim stabilization activities included radiation surveys, geodetic surveys, backfilling of the 216-B-3 Main Pond and ditch, removal of the flowmeter from the ditch, burial of the ditch headwall, abandonment of the piezometers, and excavation of five holes in the eastern portion of the pond to aid in percolation. After completion of the interim stabilization activities, a document will be provided that will summarize actual activities that occurred. This report will include the results of the surveys and the locations of the holes excavated in the main pond.

2.7 PHYSICAL SETTING

This section briefly describes the meteorology, geology, and hydrogeology of the 200-BP-11 Operable Unit and contains site-specific information not included in the B Plant AAMS Report (DOE-RL 1993c). Detailed descriptions of the physiography, surface hydrology, and environmental and human resources of the 200-BP-11 Operable Unit are discussed in Sections 3.1, 3.3, 3.6, and 3.7 of the B Plant AAMS Report. The meteorology, geology, and hydrogeology of the 200-BP-11 Operable Unit are discussed in Sections 3.2, 3.4, and 3.5 of that same document.

The Hanford Site has a semiarid climate with annual average precipitation of 16 cm (6.3 in.). Average annual temperature maximum and minimum are 18.4 °C (65.2 °F) and 5.3 °C (41.5 °F), respectively. Prevailing winds are from the northwest and west-northwest as shown in Figure 2-2.

The 200-BP-11 Operable Unit is underlain by a sequence of sedimentary deposits of late Tertiary and Quaternary age. Figures 2-3 and 2-4 represent conceptual stratigraphy beneath the northwestern and southeastern portions of the operable unit, respectively.

Thickness of the sedimentary section varies from roughly 90 m (300 ft) thick in the southeastern part of the operable unit to approximately 60 m (200 ft) in the northern portion. Vadose zone thickness varies from approximately 60 m (200 ft) in the northwest corner of the operable unit, to 30 m (100 ft) in the southeast. The most prominent aquitard/semi-confining layer is the lower mud sequence of the Ringold Formation. The lower mud acts as a perching horizon locally and as a semi-confining layer in the extreme southeast part of the operable unit.

The uppermost aquifer occurs mostly within the Hanford formation in the northern half of the operable unit and within Unit A gravels of the Ringold Formation in the south.

Figures 2-5 through 2-10 are isopach and structure maps of the Ringold and Hanford sediments, as well as the surface of the underlying Elephant Mountain Member basalt, within and near the 200-BP-11 Operable Unit. As shown by Figures 2-6 through 2-9, the Ringold Formation is discontinuous over the northern portions of the operable unit. The Ringold lower mud sequence thins northward and is absent in the vicinity of the main pond. The surfaces of contact between the Elephant Mountain Member basalt and the Ringold Unit A, and contacts between all the succeeding units above, generally dip to the south within the operable unit.

Stratigraphic columns representing stratigraphy near specific waste management units are shown in Figures 2-11 through 2-17. These columns are derived from one or two representative wells in the immediate vicinity of the waste management unit as shown in Figure 2-18 and Plate 1. Although most groundwater monitoring wells in the operable unit have been logged for gross gamma, only one well (699-40-40B) was logged for specific radionuclides with the spectral gamma method. No manmade radionuclides were detected in this well.

Wells used to construct cross sections and stratigraphic columns are shown in Figure 2-18. Most of the wells used in construction of these diagrams are RCRA groundwater monitoring wells of recent construction. Geologic data from these wells are more reliable than data from logs of older wells. Geologic cross sections representative of areas hosting waste management units are shown in Figures 2-19 through 2-23. Recent investigations for the 200 Areas TEDF (Davis et al. 1993) have enhanced understanding of the subsurface in the southeast portion of the operable unit. Cross sections extending between the TEDF and the 216-B-3 Pond System are shown in Figures 2-19 and 2-20. The cross section most representative of the area under investigation for the operable unit is shown in Figure 2-23.

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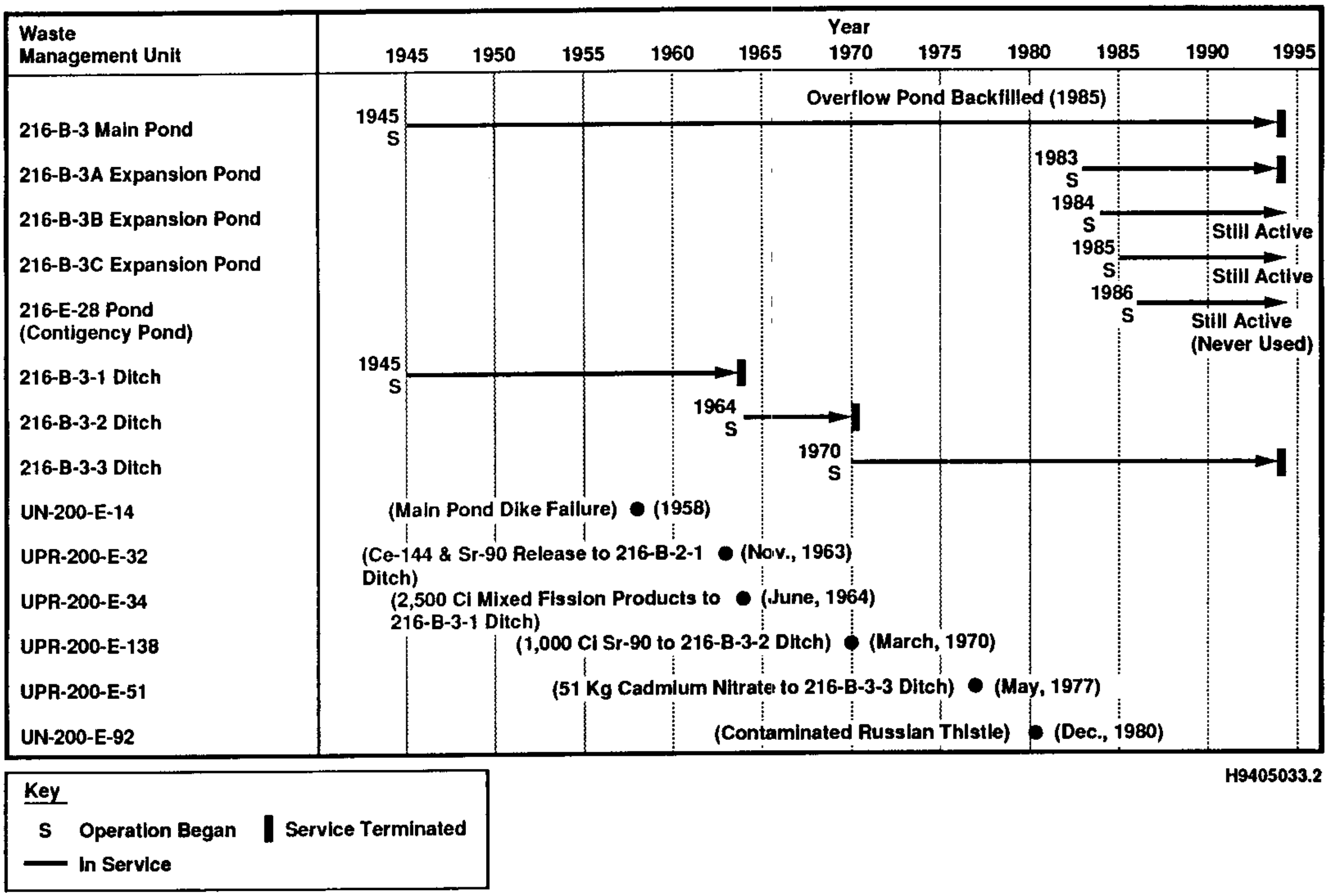


Source: WHC 1991c

Figure 2-1. Operational History of the 200-BP-11 Waste Management Units.

Figure 2-2. Hanford Site Wind Roses, 1979 Through 1982.

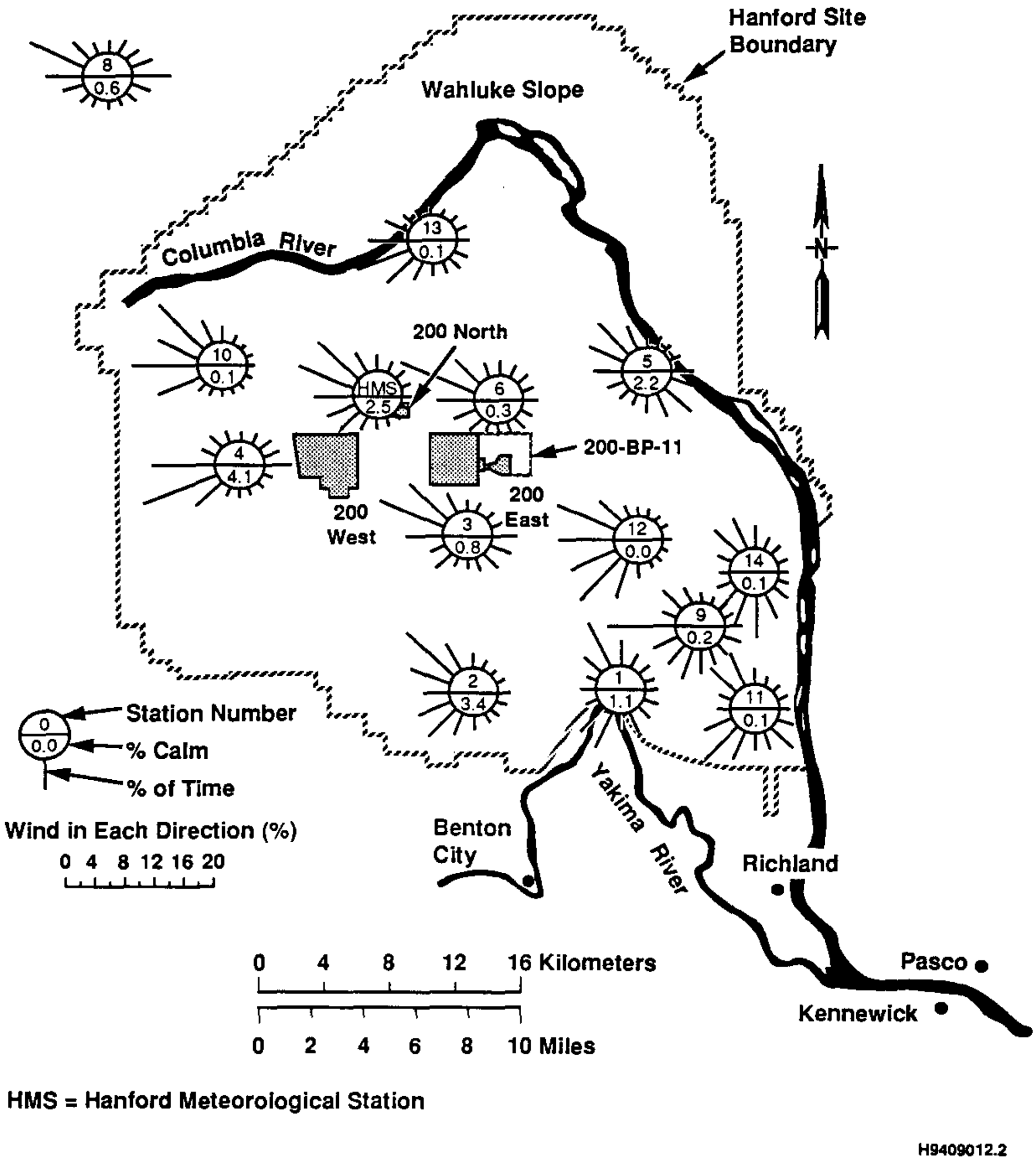


Figure 2-3. Conceptual Stratigraphic Column for the 200-BP-11 Operable Unit (northwest portion).

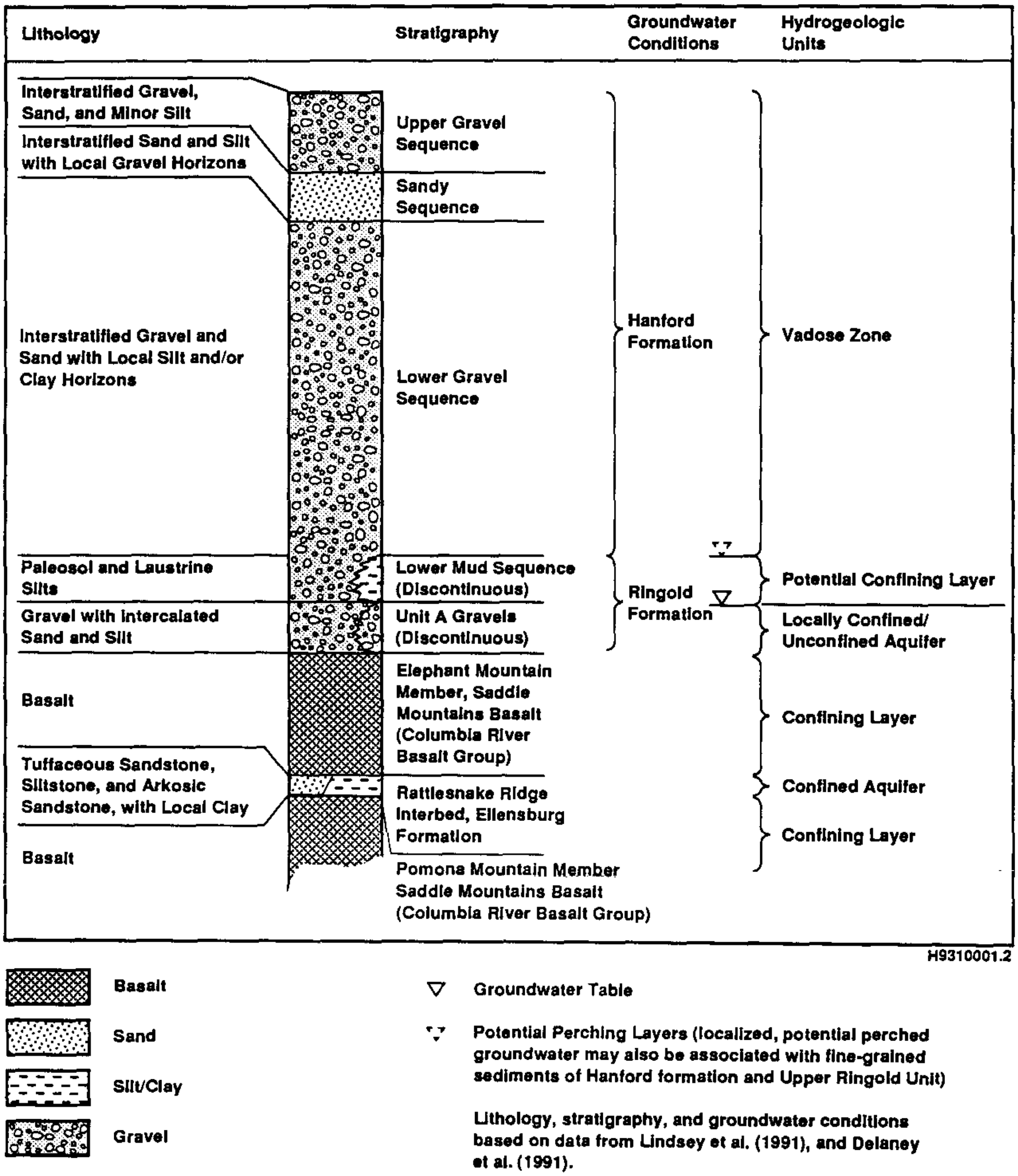
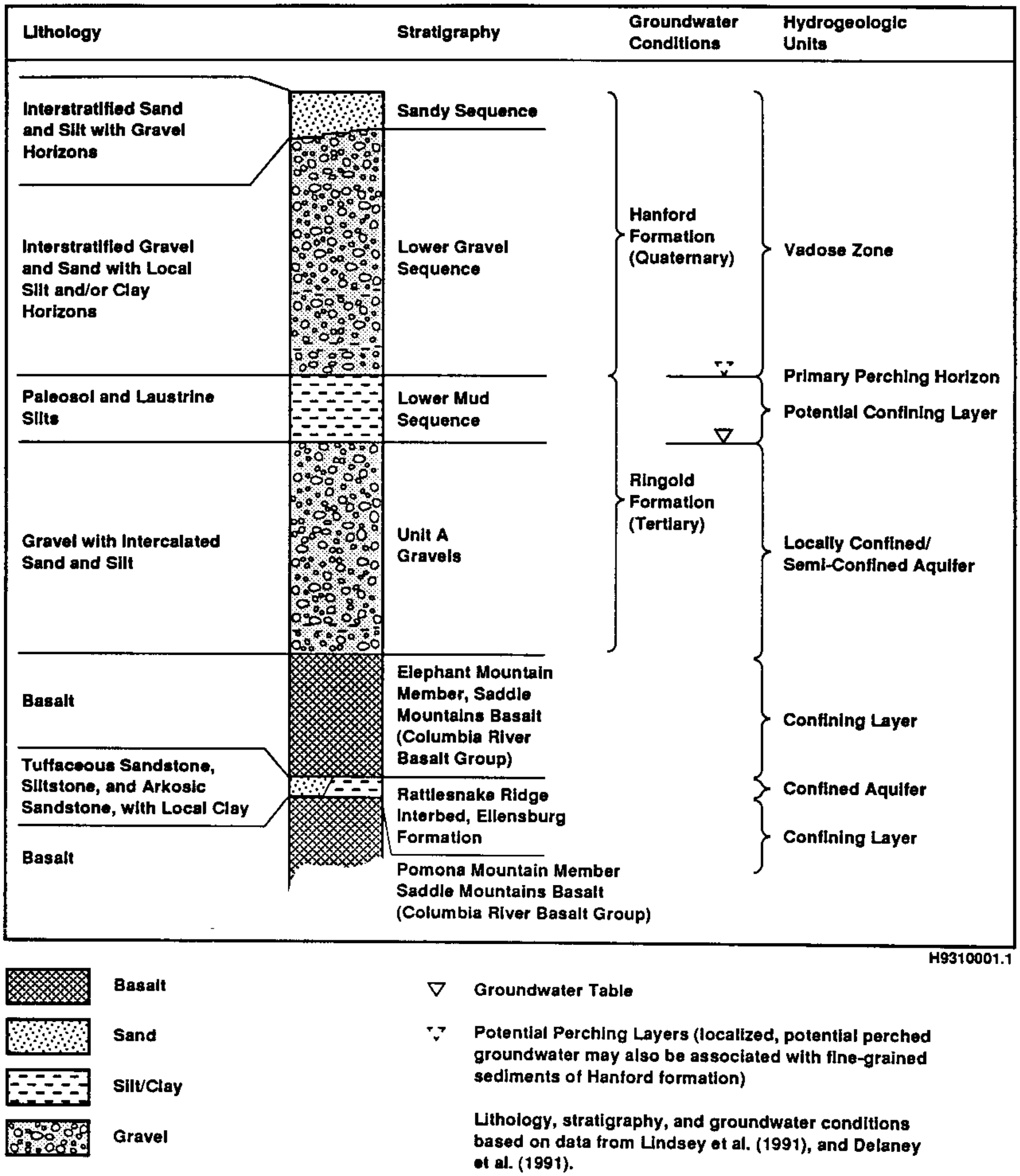


Figure 2-4. Conceptual Stratigraphic Column for the 200-BP-11 Operable Unit (southeast portion).



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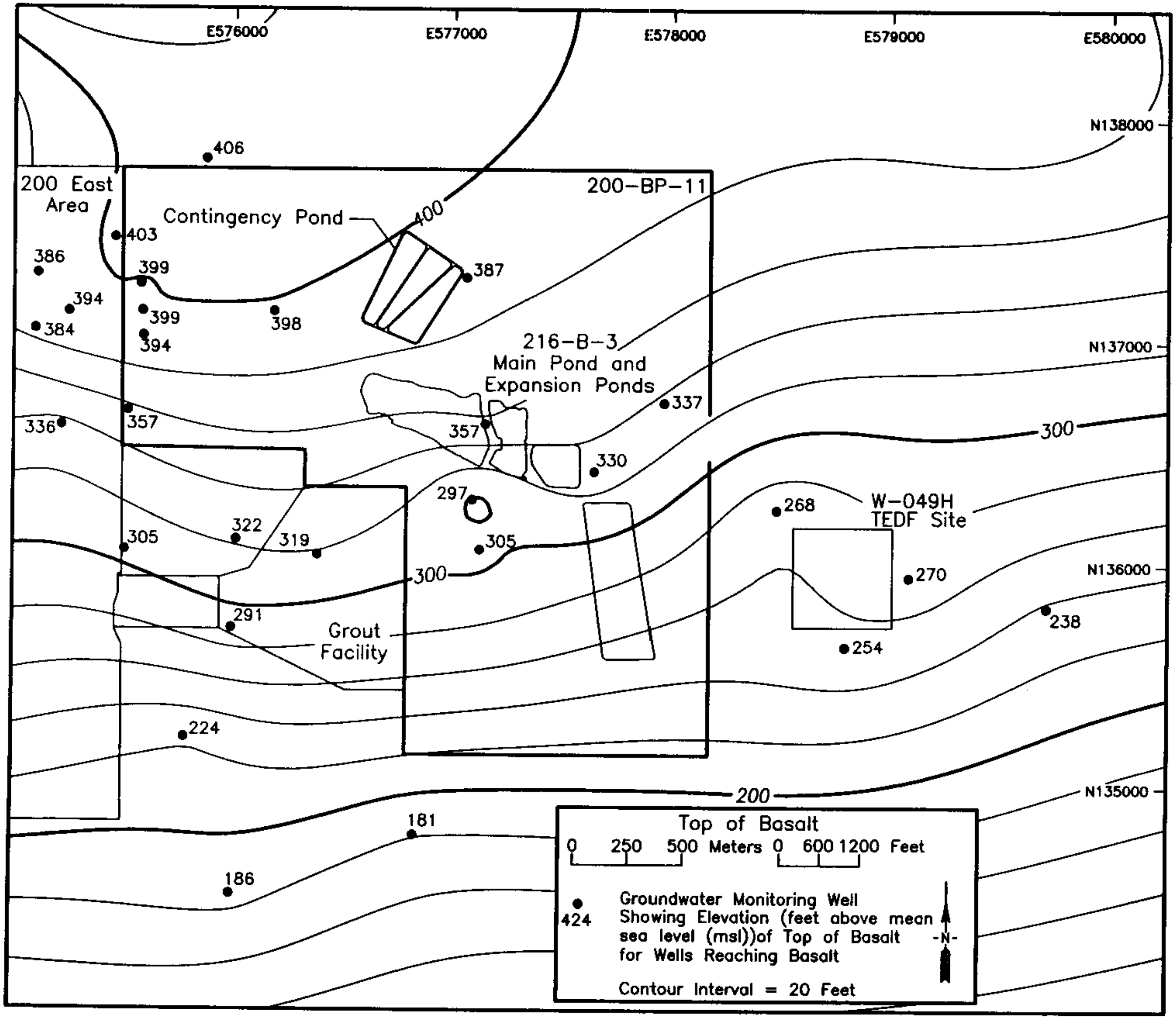

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Figure 2-5. Structure Contour Map of the Top of the Elephant Mountain Member for the 200-BP-11 Operable Unit.

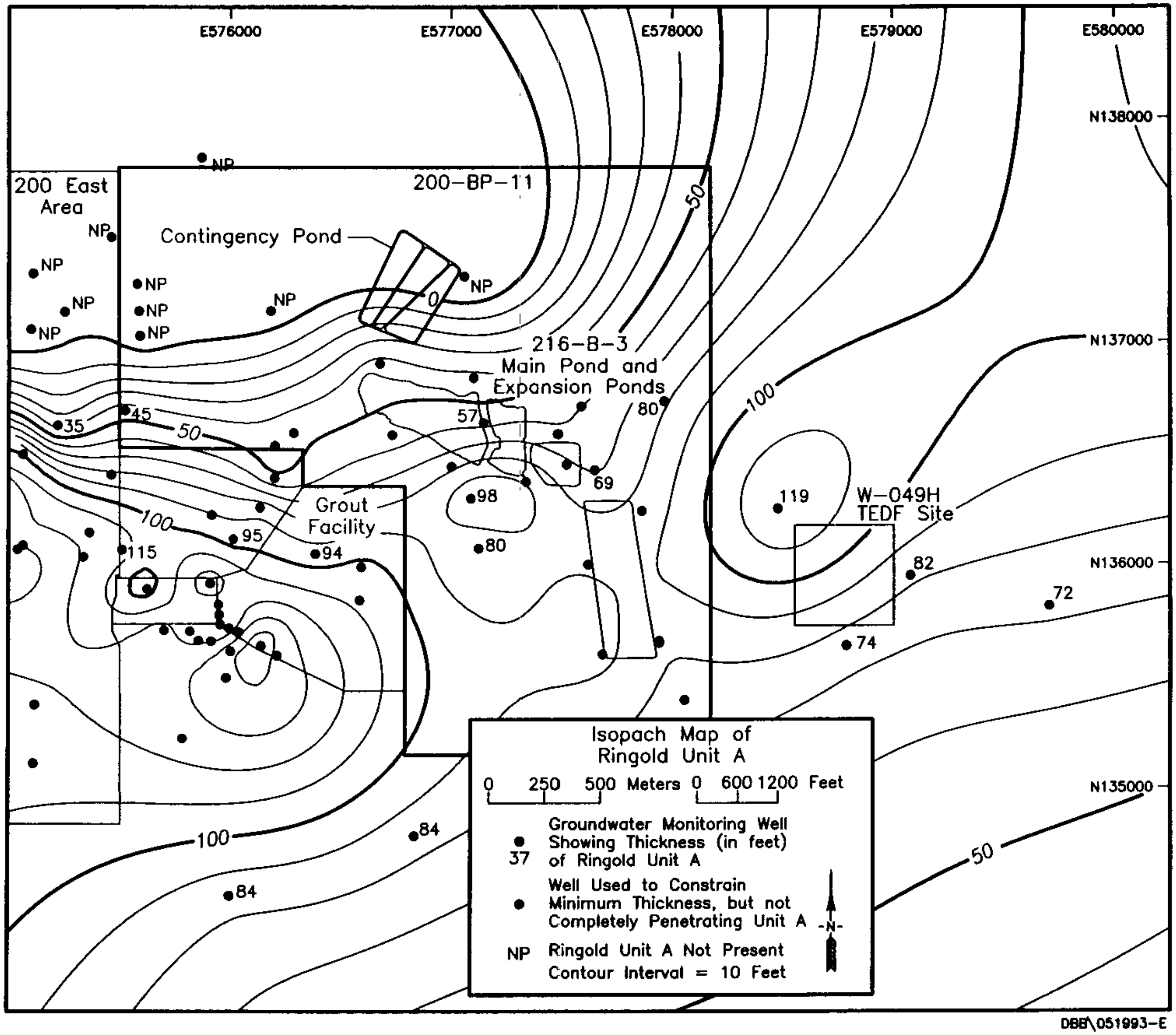

Figure 2-6. Isopach Map of Unit A of the Ringold Formation for the 200-BP-11 Operable Unit.

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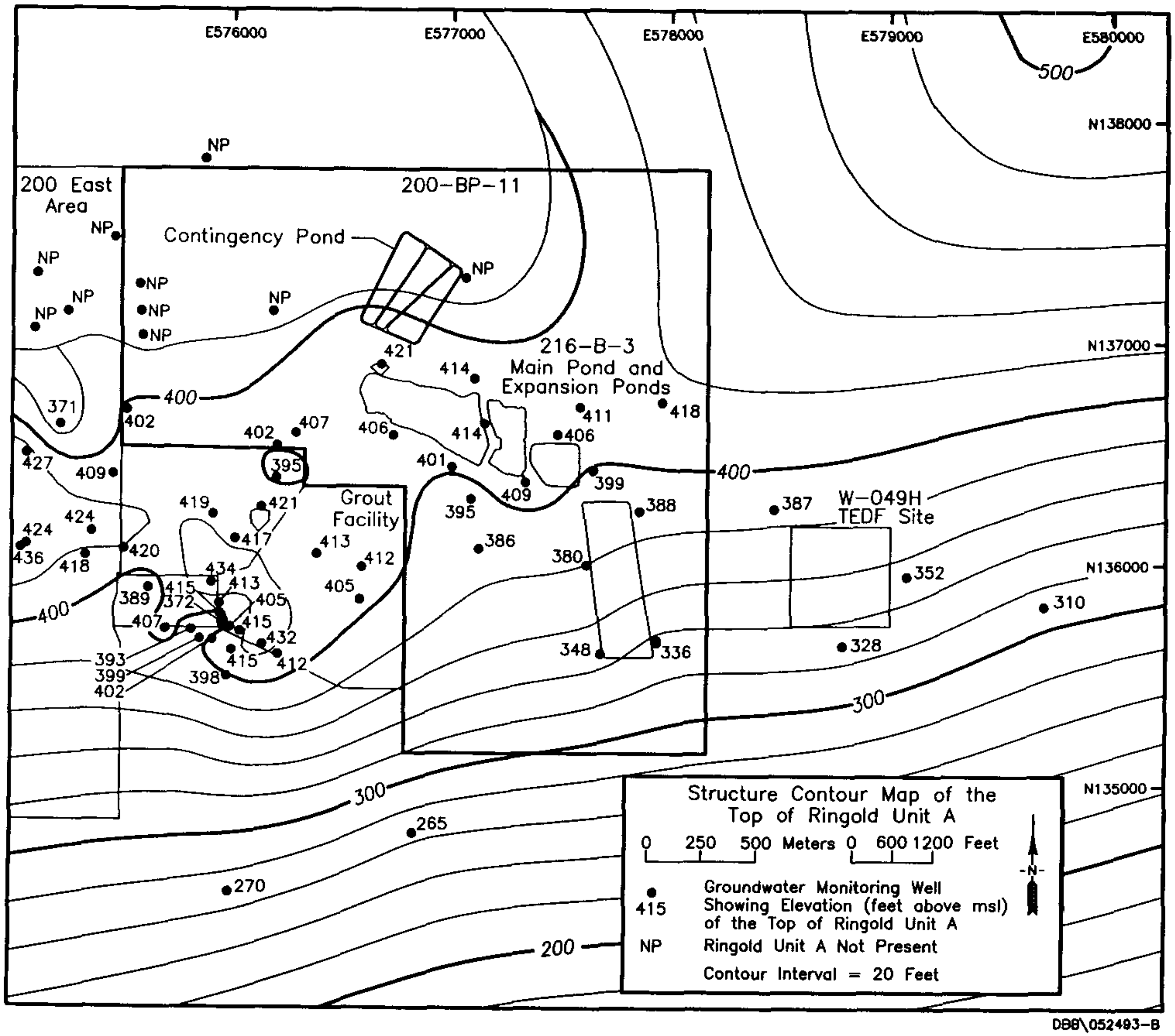

Figure 2-7. Structure Contour Map of the Top of Unit A of the Ringold Formation for the 200-BP-11 Operable Unit.

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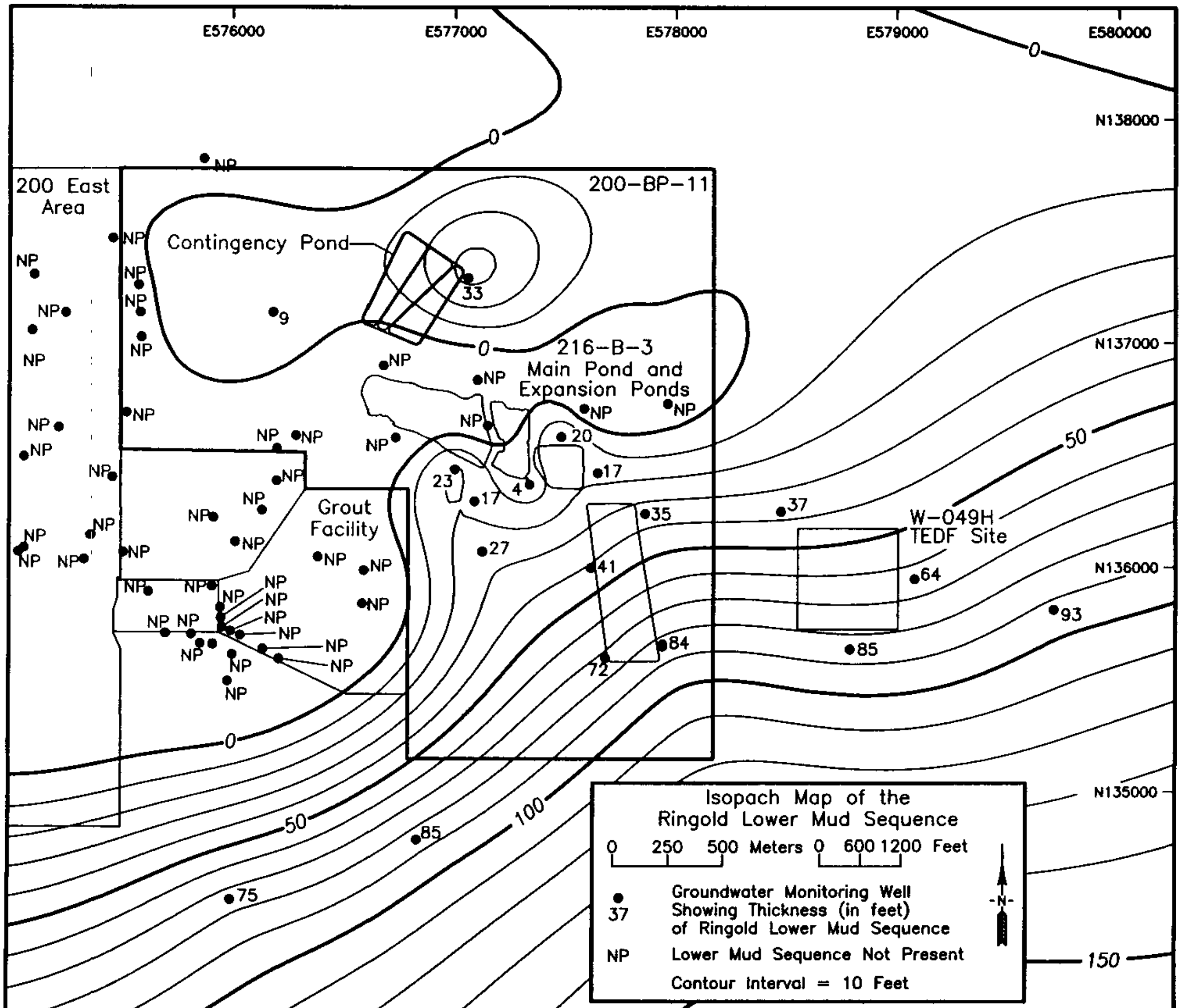

DBB\052093-E

Figure 2-8. Isopach Map of the Ringold Formation Lower Mud Sequence for the 200-BP-11 Operable Unit.

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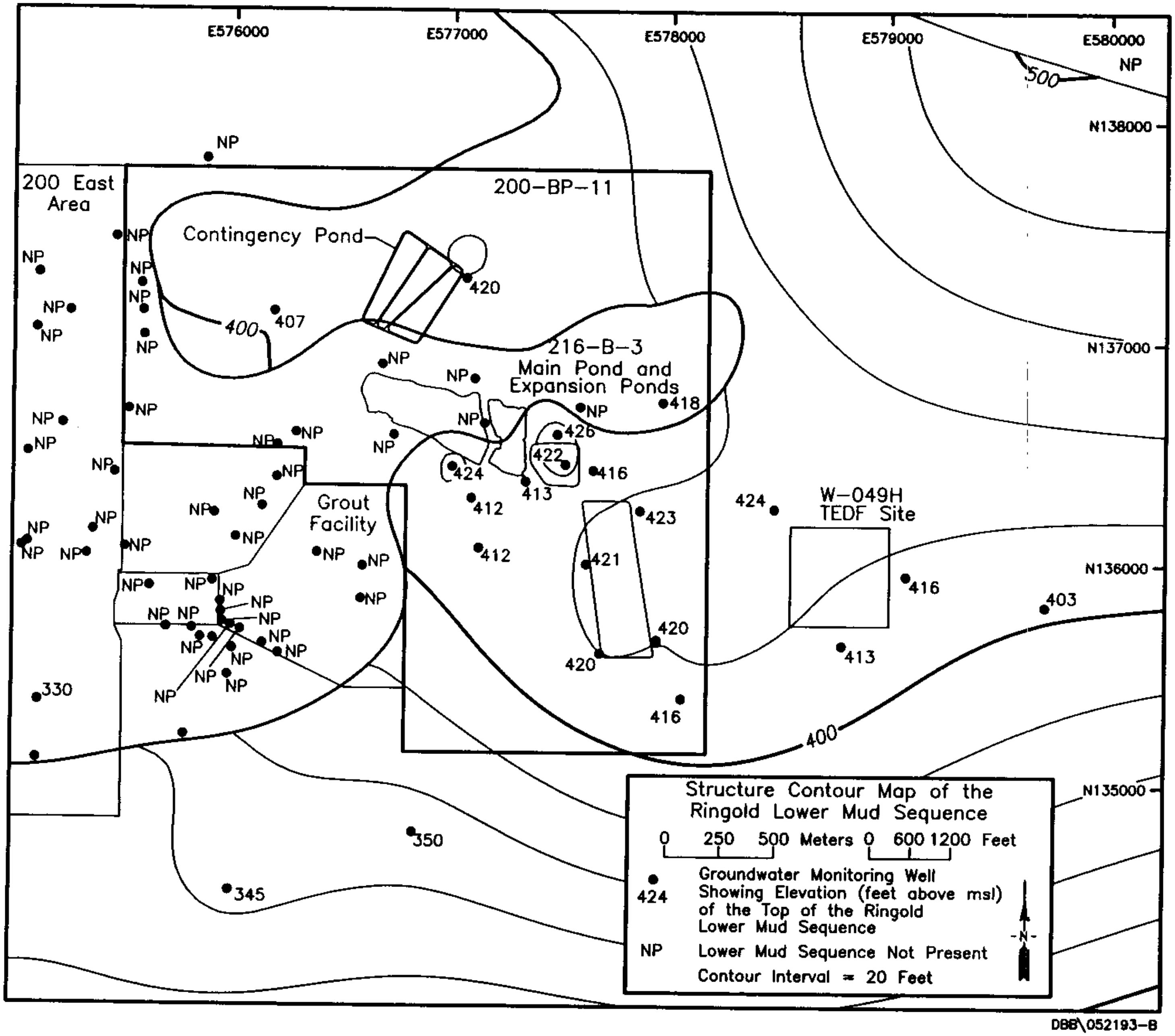

Figure 2-9. Structure Contour Map of the Ringold Lower Mud Sequence for the 200-BP-11 Operable Unit.

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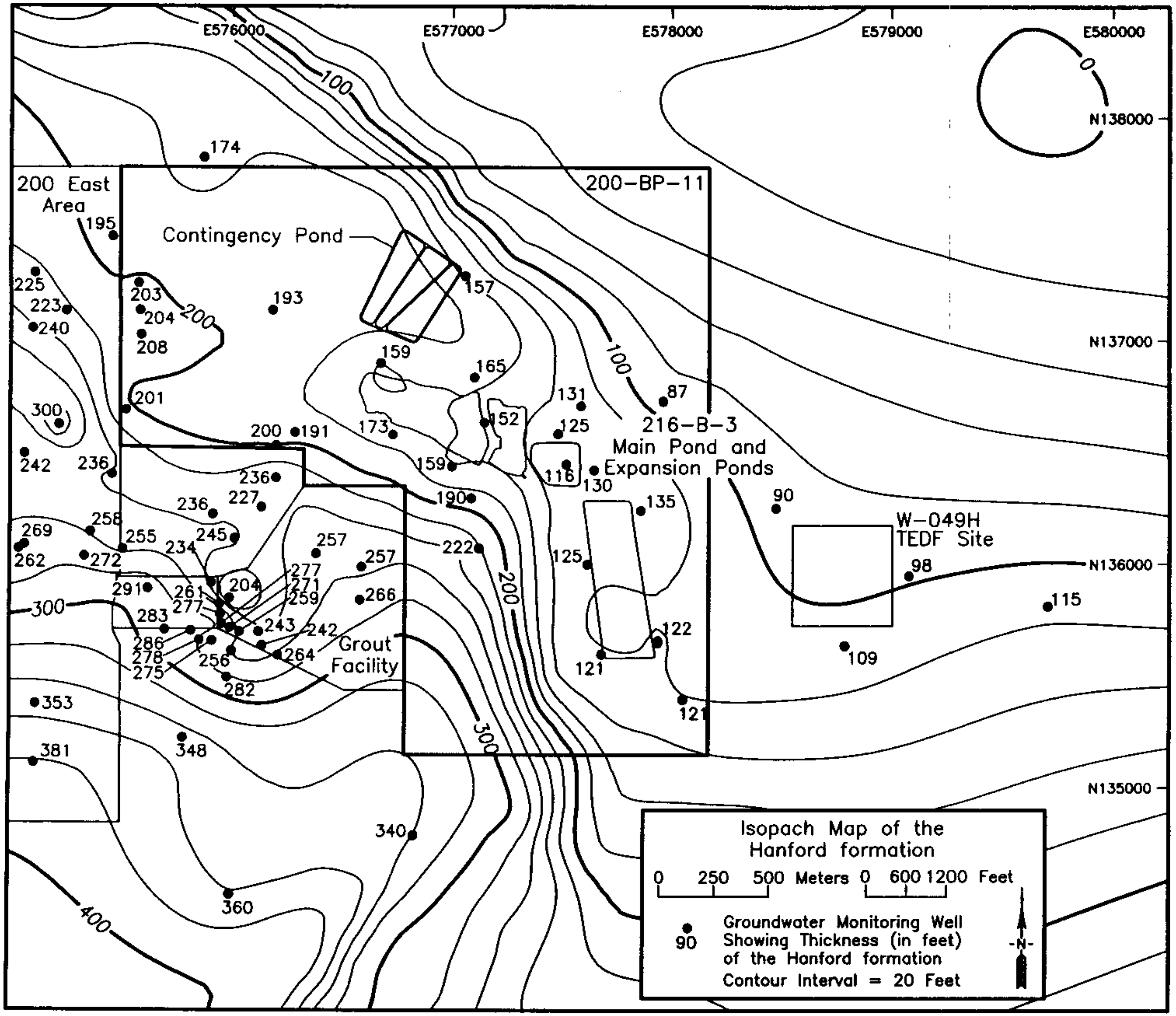

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Figure 2-10. Isopach Map of the Hanford Formation for the 200-BP-11 Operable Unit.

Figure 2-11. Representative Stratigraphy Immediately North of the Liquid Effluent Retention Facility.

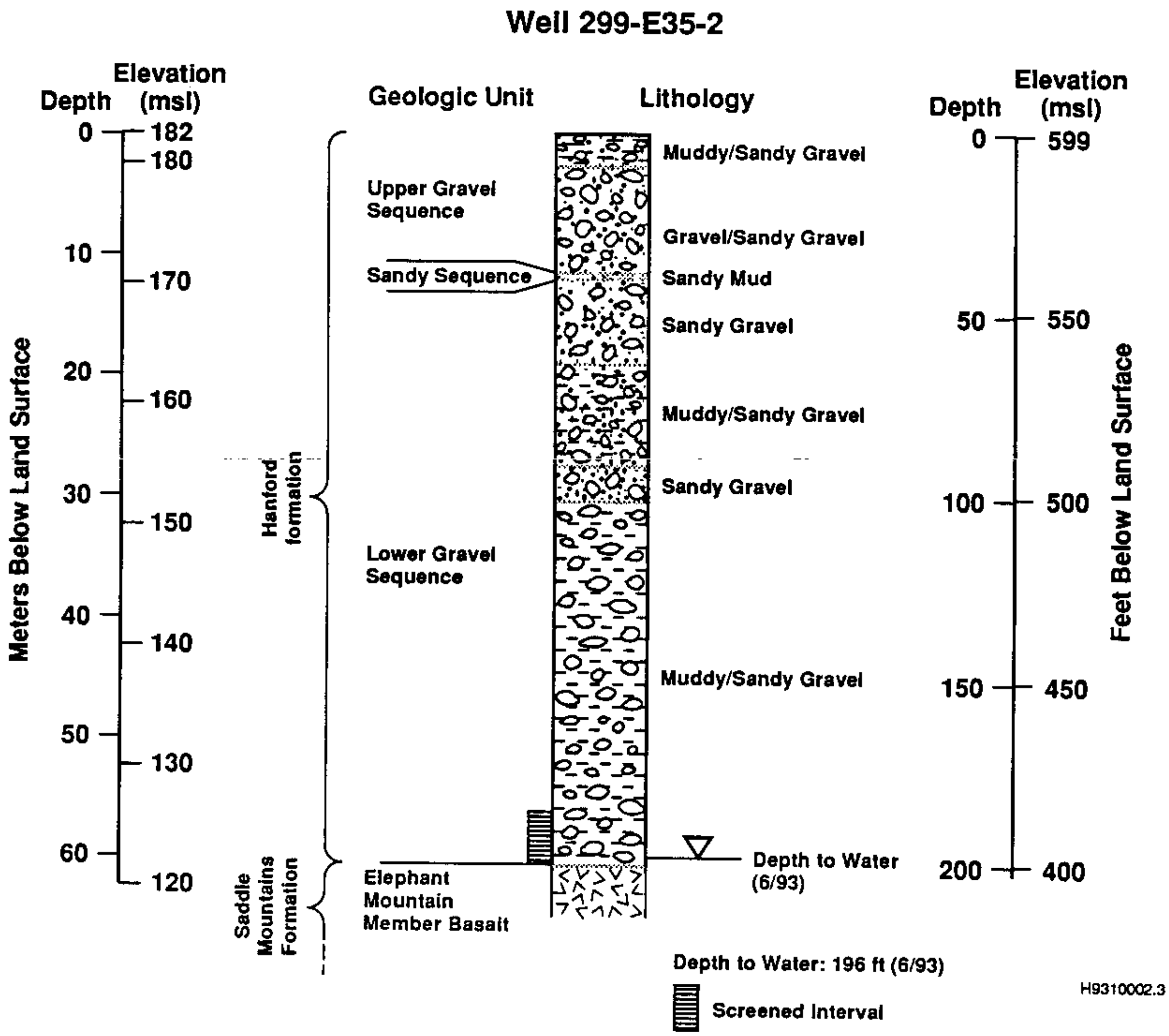


Figure 2-12. Representative Stratigraphy Between the 216-B-3 Main Pond and the 216-E-28 Contingency Pond.

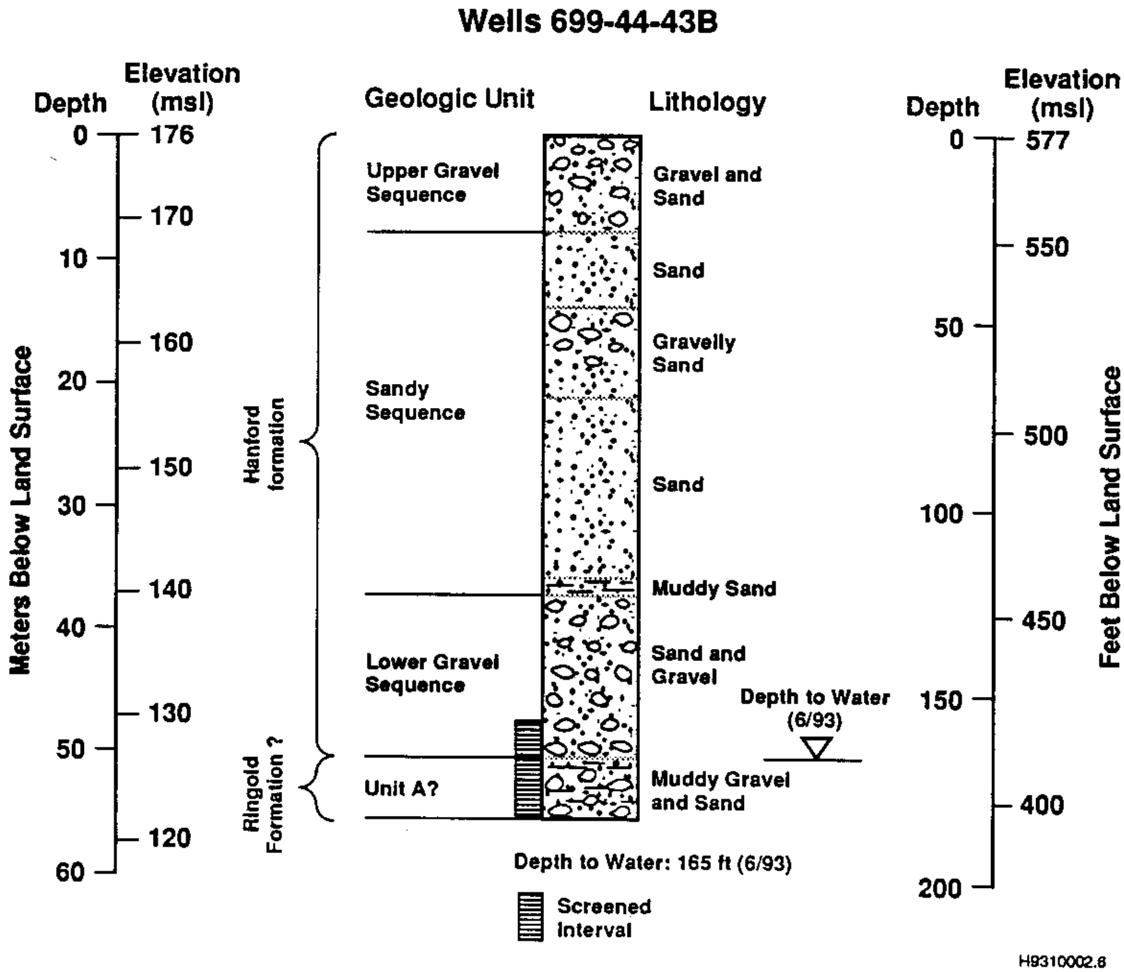


Figure 2-13. Representative Stratigraphy for the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches near the 216-B-3 Main Pond.

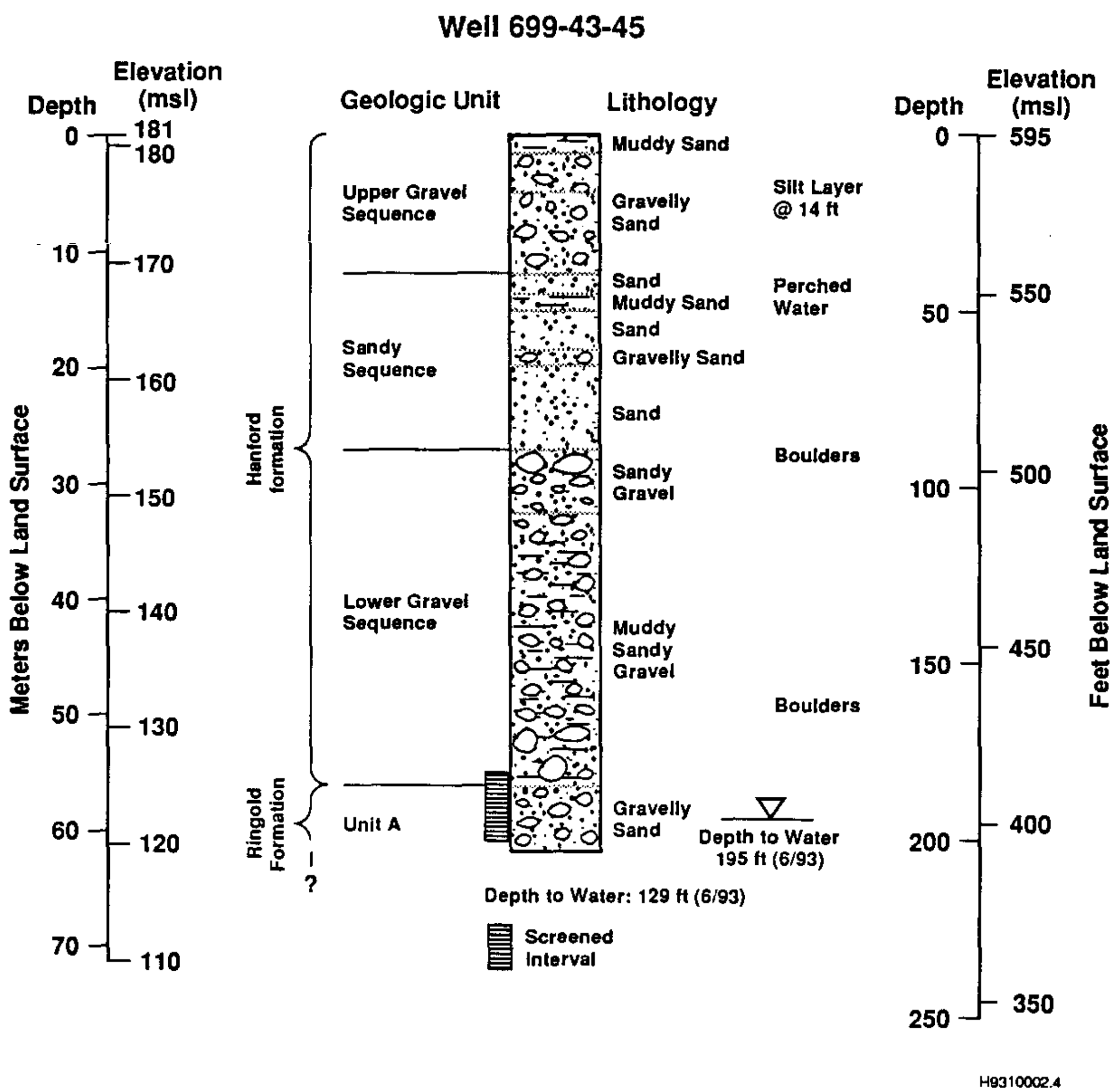


Figure 2-14. Composite Representative Stratigraphy for the 216-B-3 Main Pond (southern part).

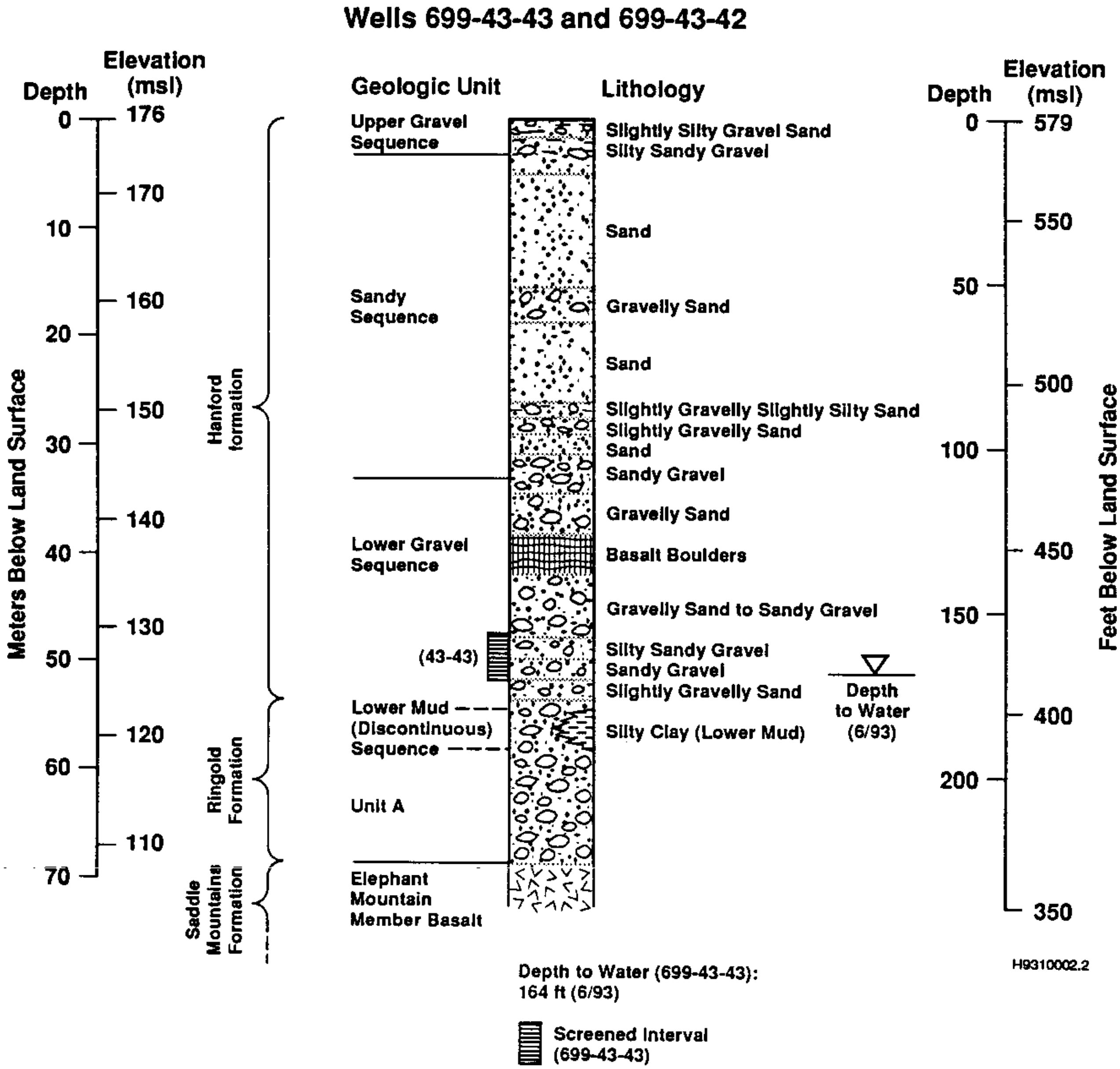


Figure 2-15. Composite Representative Stratigraphy Between the 216-B-3A and 216-B-3B Expansion Ponds.

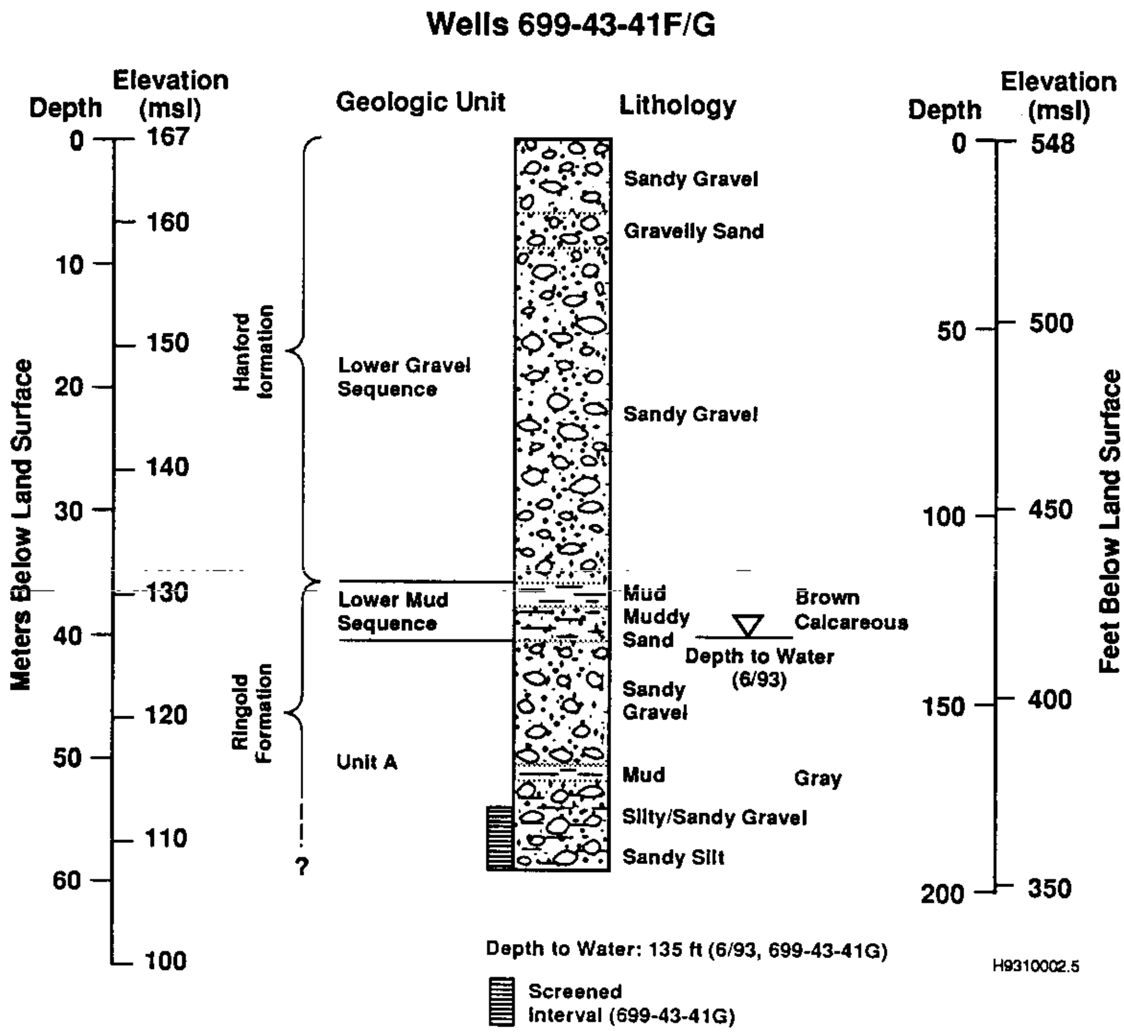


Figure 2-16. Composite Representative Stratigraphy Between the 216-B-3B and 216-B-3C Expansion Ponds.

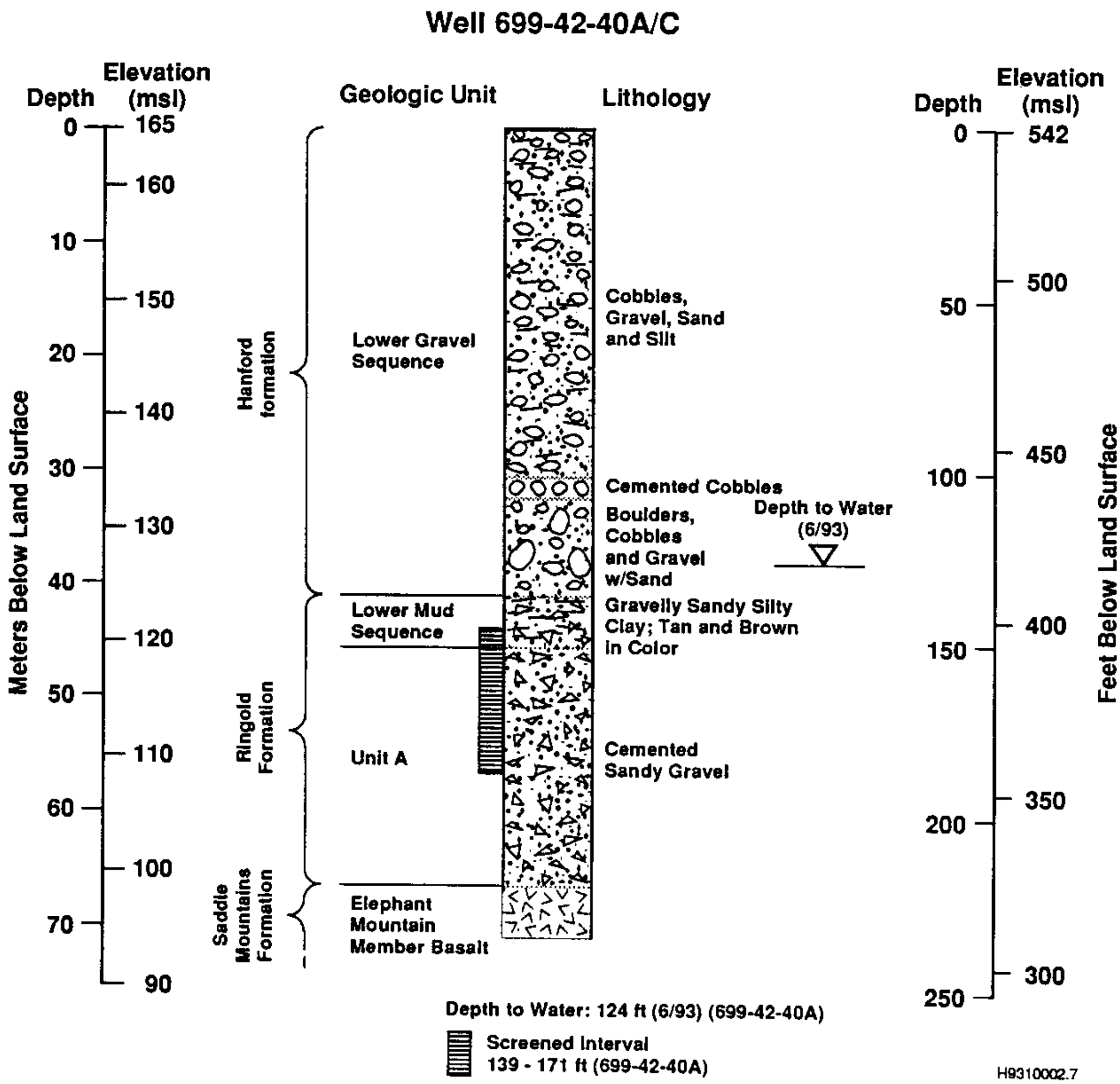
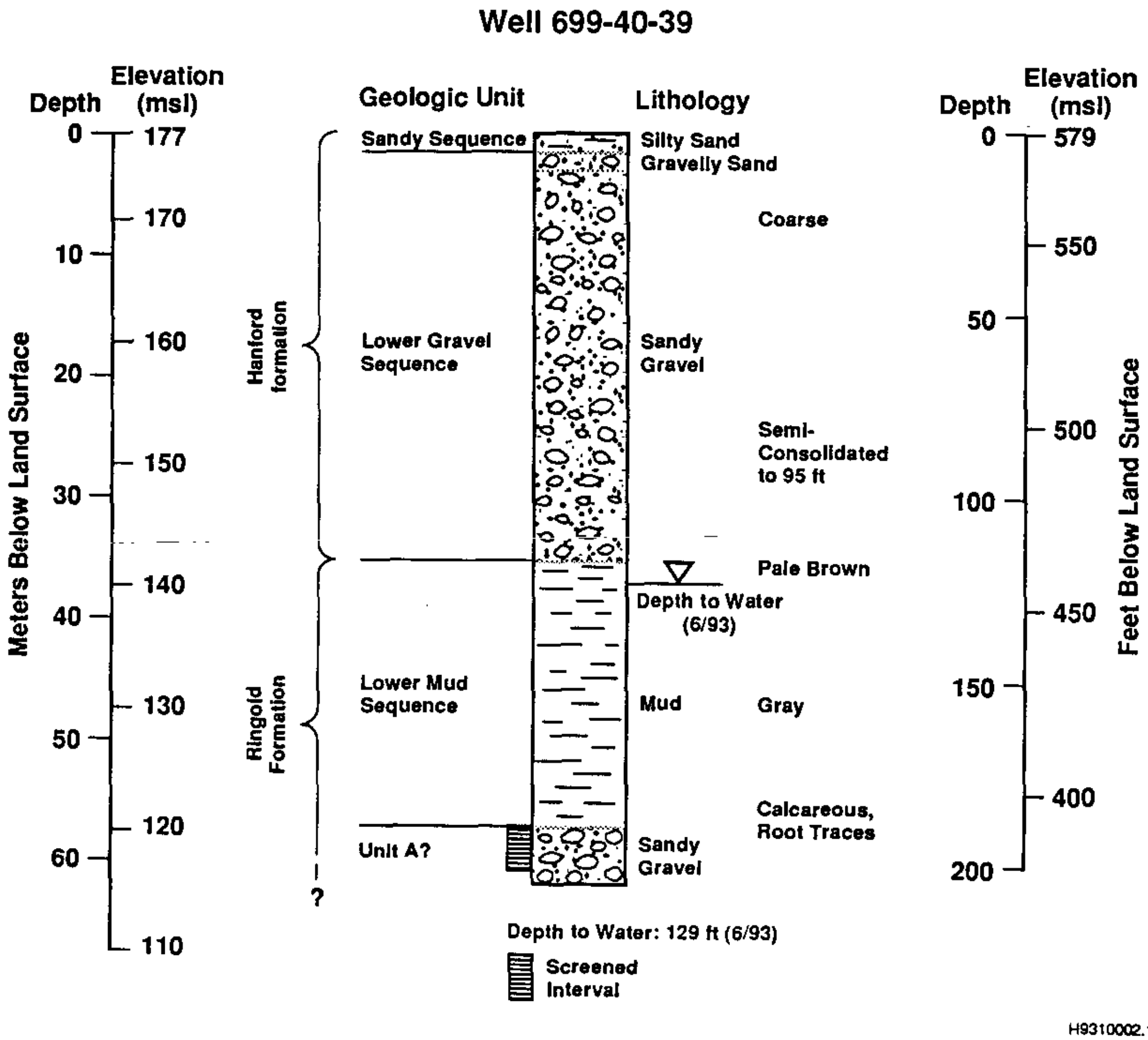


Figure 2-17. Representative Stratigraphy near the South End of the 216-B-3C Expansion Pond.



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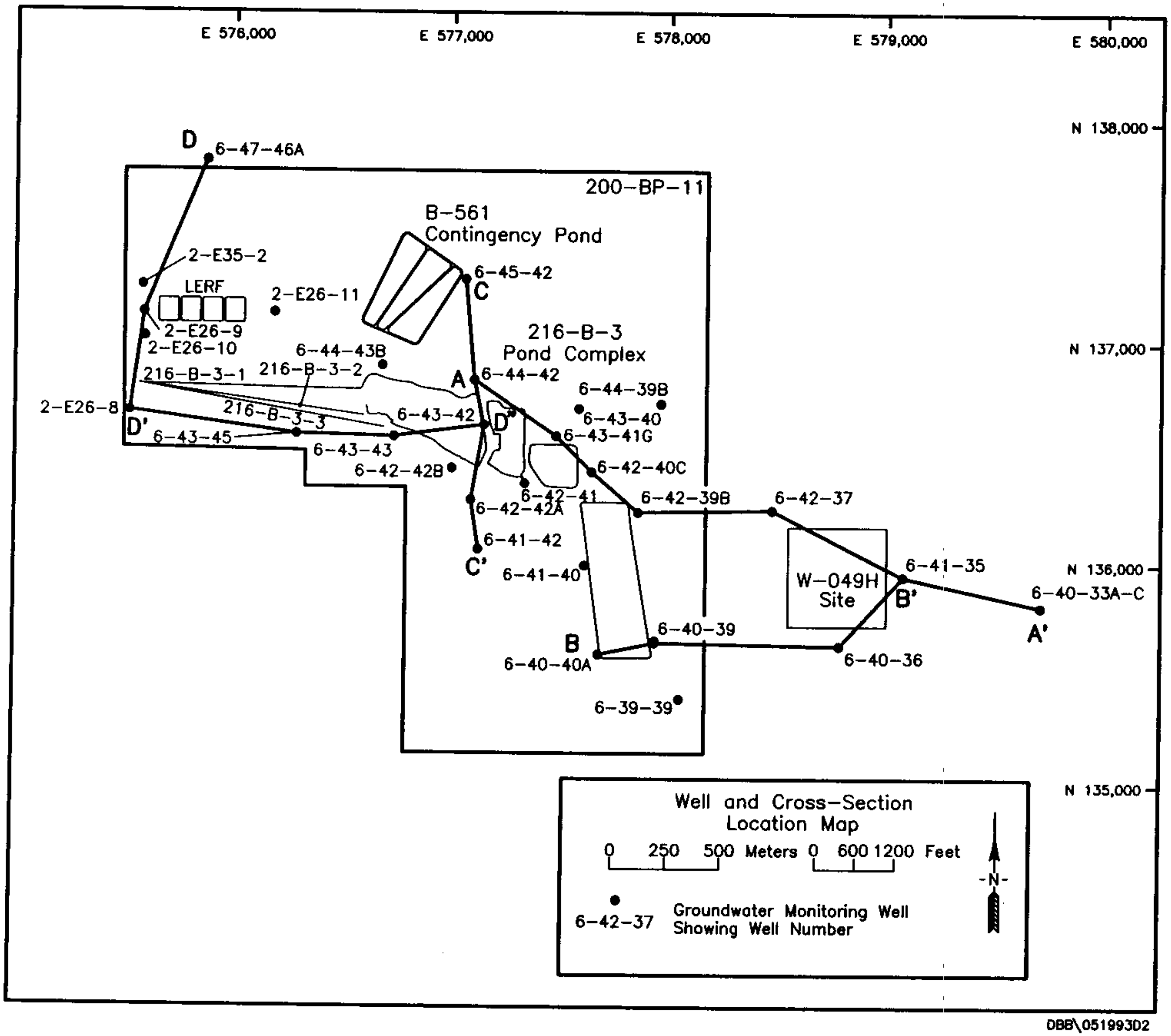

Figure 2-18. Well and Cross-Section Location Map for the 200-BP-11 Operable Unit.

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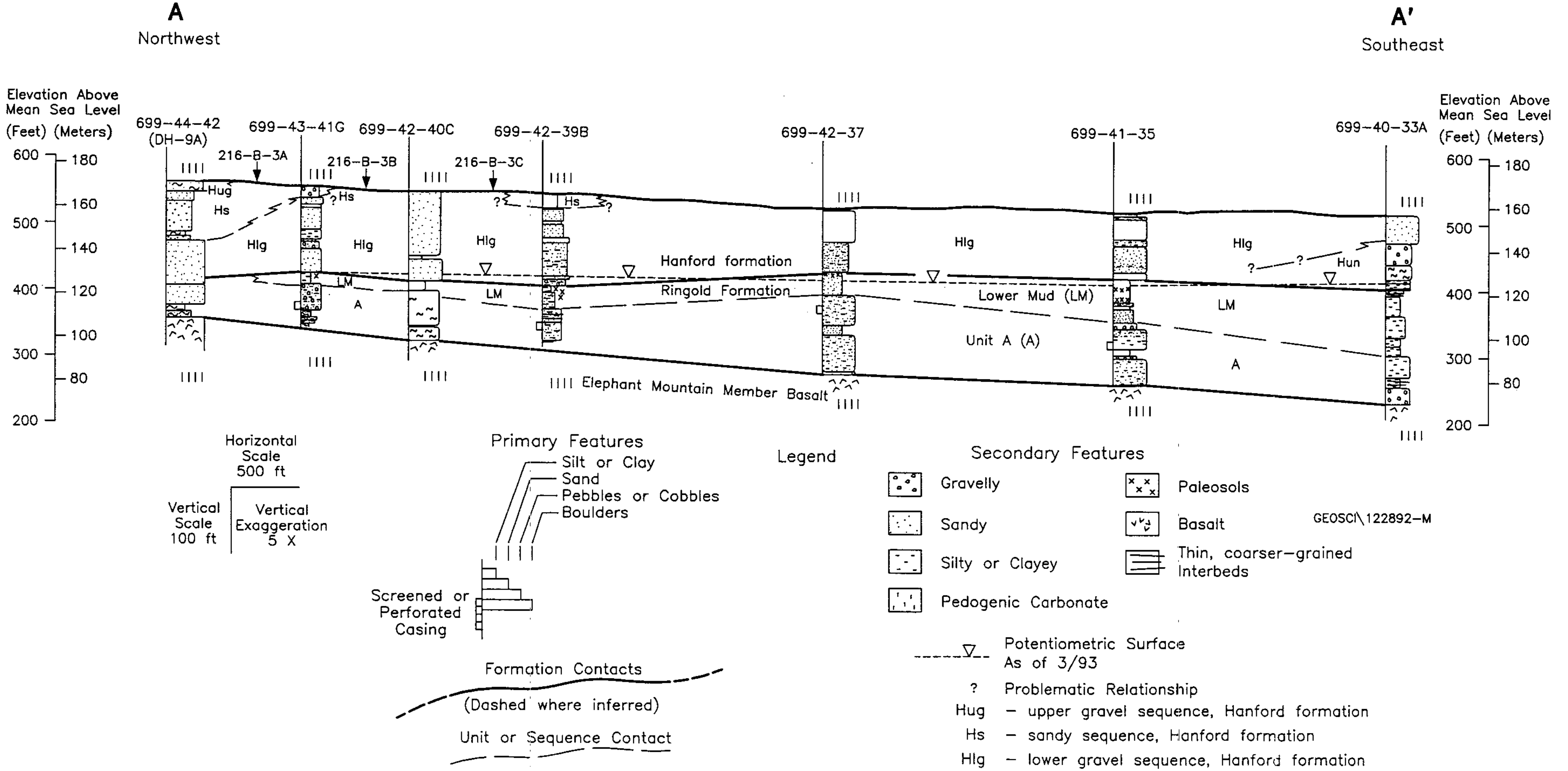

Figure 2-19. Cross Section A-A' f[or] the 200-BP-11 Operable Unit.

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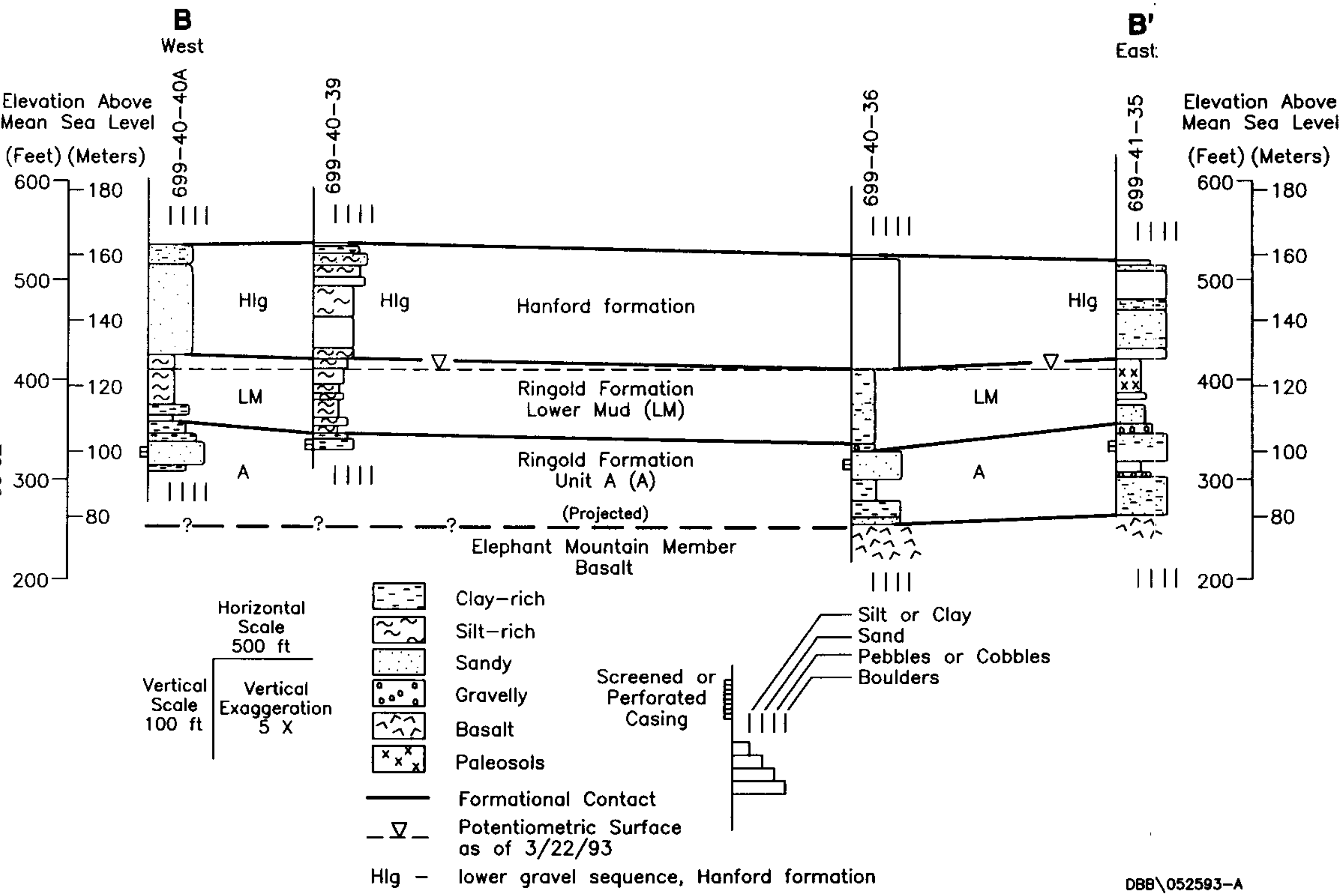

Figure 2-20. Cross Section B-B' for the 200-BP-11 Operable Unit.

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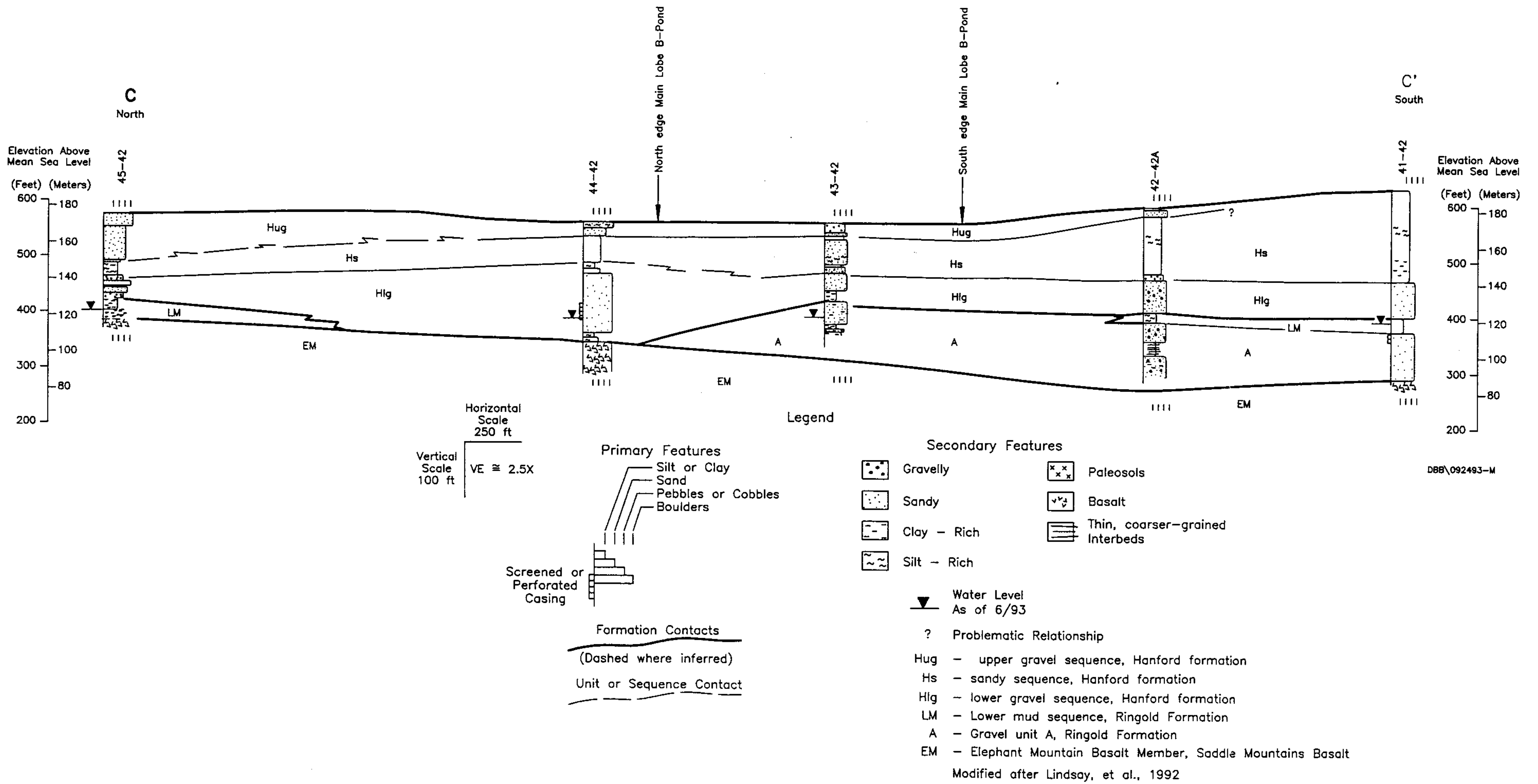

Figure 2-21. Cross Section C-C' for the 200-BP-11 Operable Unit.

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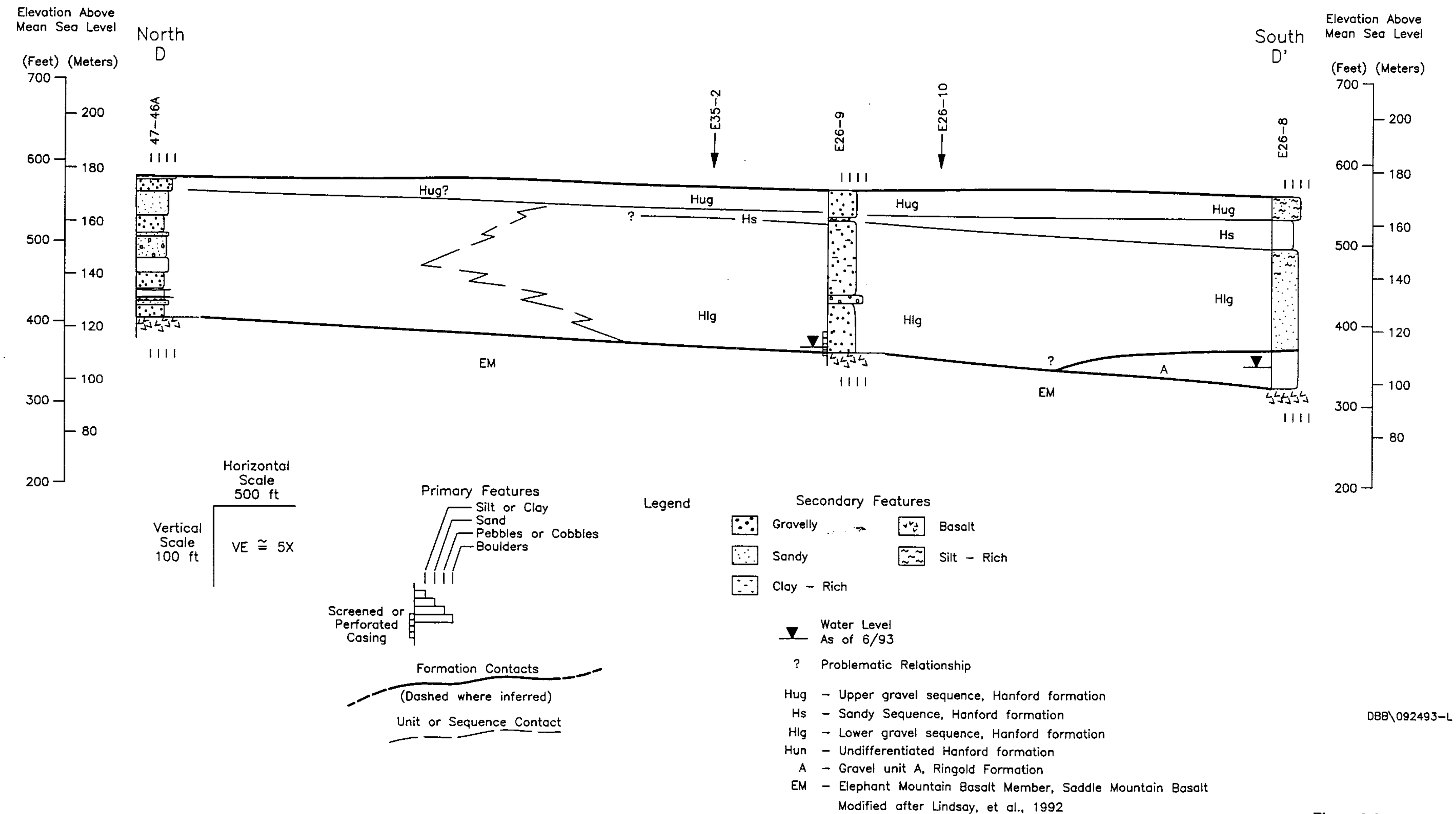

Figure 2-22. Cross Section D-D' for the 200-BP-11 Operable Unit.

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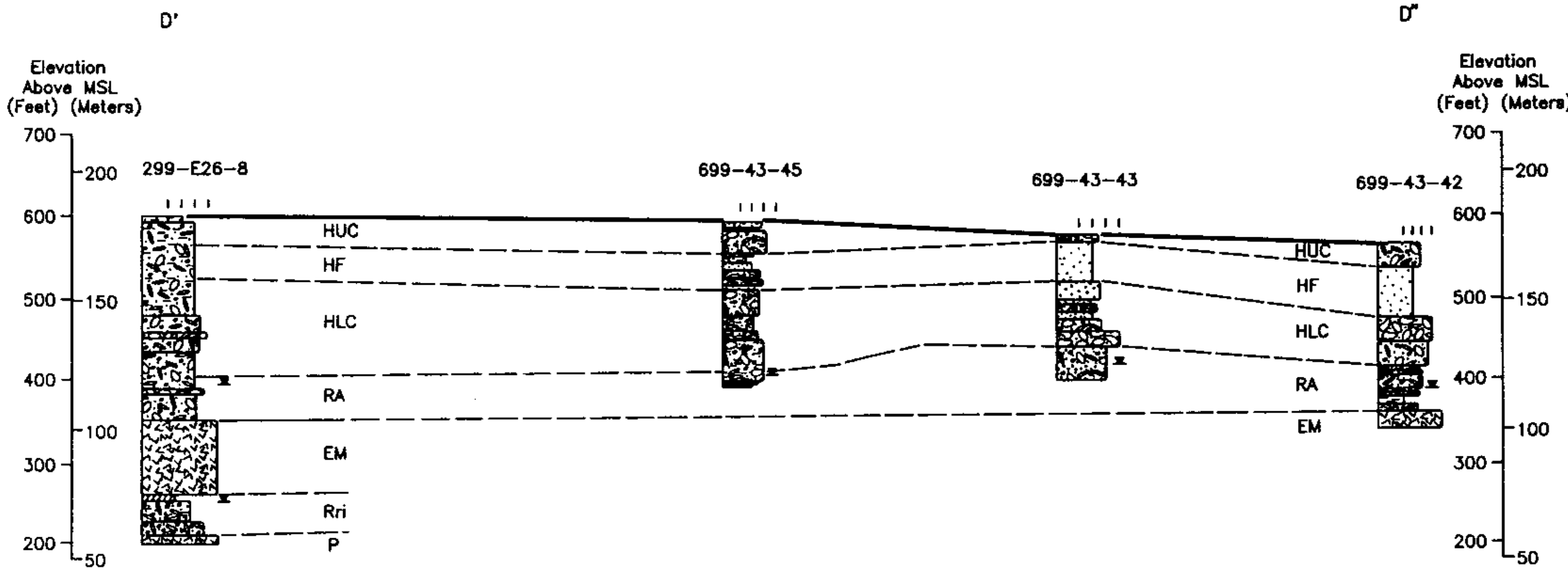

Horizontal Scale 500 ft

Vertical Scale 100 ft

Vertical Exaggeration 5 X

HUC = Hanford upper coarse formation
HF = Hanford fine formation
HLC = Hanford lower coarse formation
RA = Ringold unit A Formation
EM = Elephant Mountain Member, Saddle Mountain Basalt
Rri = Rattlesnake Ridge interbed
P = Pomona Member, Saddle Mountain Basalt

200BP11

Cross Section D' – D" for the 200-BP-11 Operable Unit

Figure 2-23. Cross Section D'-D" for the 200-BP-11 Operable Unit.

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Table 2-1. Physical Characteristics of Waste Management Units, 200-BP-11 Operable Unit.

Waste Management Unit	Depth	Plan dimensions	Comments
216-B-3 Main Pond	0.6 m (2 ft) to 6 m (20 ft)	14 hectares (35 acres)	Adjoined at the western end by a 1.7-hectare (4-acre) backfilled "Overflow Pond." Bentonite added in 1964. Decommissioned and backfilled in 1994.
216-B-3A Expansion Pond	Approx. 1 m (3.3 ft)	4 hectares (10 acres)	Decommissioned (not backfilled) in 1994.
216-B-3B Expansion Pond	Approx. 1 m (3.3 ft)	4 hectares (10 acres)	Empty since 1984, but still active.
216-B-3C Expansion Pond	2.0 m (6.6 ft) to 3.0 m (10 ft)	17 hectares (41 acres)	Contains eight parallel trenches in bottom to increase infiltration capacity. Currently in use.
216-E-28 Contingency Pond	1.2 m (4 ft)	12 hectares (30 acres)	Three ponds, built for emergency use in 1986--never used but remains active.
216-B-3-1 Ditch	1.8 m (6 ft)	975 m (3,200 ft) long	Decommissioned and backfilled in 1964.
216-B-3-2 Ditch	1.2 m (4 ft) to 2.4 m (8 ft)	1,128 m (3,700 ft) long	Decommissioned and backfilled in 1970.
216-B-3-3 Ditch	1.8 m (6 ft)	1,128 m (3,700 ft) long	Decommissioned and backfilled in 1994.

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3.0 INITIAL EVALUATION

This chapter briefly describes the process information, known and suspected contamination, potential impacts to human health and the environment, potential CMRs, and the preliminary corrective measure objectives and alternatives for the 200-BP-11 Operable Unit. Section 3.1 summarizes the current effluent discharges to the operable unit as discussed in Chapter 3.0 of the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b). Section 3.2 summarizes the types of contamination data available for the operable unit and what they indicate of the distribution and character of the contamination. These data include a summary of Section 4.1 (Known and Suspected Contamination) in the *B Plant Source Aggregate Area Management Study Report* (DOE-RL 1993c) and *PUREX Plant Source Aggregate Area Management Study Report* (DOE-RL 1993f), and a summary of Phase 1, 2, and 3 sampling results in the *216-B-3 Expansion Ponds Closure Plan*. Section 3.3 discusses the conceptual model and potential concerns to human health and the environment as developed in Section 4.2 and Chapter 5.0 of the B Plant Aggregate Area Management Study (AAMS) Report (DOE-RL 1993c). Physical conceptual models for individual waste management units are provided in Chapter 4.0 of this work/closure plan. Section 3.4 is a summary of the CMRs from Chapter 6.0 of the B Plant AAMS Report, and Section 3.5 discusses the possible IRMs presented in Chapter 7.0 of the B Plant AAMS Report.

3.1 PROCESS INFORMATION

Currently, the 216-B-3C Expansion Pond is the only waste management unit in the 200-BP-11 Operable Unit that receives effluents. These nondangerous discharges are the cooling water from B Plant (221 Building), 242-A Evaporator, 241-A Aging Waste Ventilation System Complex, and 244-AR Vault. In addition, the operable unit receives discharges from the B Plant and PUREX Plant chemical sewers, 283-E Water Treatment Facility, and the 284-E Powerhouse. In the past, the operable unit received waste water from PUREX Plant cooling water, 244-CR Vault, 242-B Evaporator, 244-BXR Vault, and 241-BY Tank Farm. The operable unit has also received waste water from several miscellaneous sources, such as construction activities. Other waste streams may be discharged to the operable unit in the future. Figure 3-1 depicts the current flow routes to the operable unit. Table 3-1 provides a summary of potential contaminants of concern resulting from these discharges to the operable unit. Table 3-2 provides the final list of analytes for the operable unit. A complete description of the above discharge streams is provided in Chapter 3.0 of the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b).

3.2 KNOWN AND SUSPECTED CONTAMINATION

This section summarizes the known and suspected contamination data for the 200-BP-11 Operable Unit. A thorough search was performed to assess the known and suspected contamination from each of the process streams discussed in Section 3.1 and is documented in the B Plant and PUREX Plant Source AAMS Reports (Tables 4-22 and 4-32, respectively; DOE-RL 1993c, 1993f) and the *216-B-3 Expansion Ponds Closure Plan* (Section 4 Tables) (DOE-RL 1993b). Additionally, the Form 3 for the 216-B-3 Main Pond (Appendix B) was reviewed to ensure that the contaminants listed on the form were considered in the evaluation of potential contaminants of concern. All contaminants identified in this search are listed in Table 3-1. It should be noted that Table 3-1 includes all candidate contaminants of potential concern to the entire B Plant Aggregate Area and is therefore considered a conservative list with respect to the 200-BP-11 Operable Unit.

Three major sampling events have taken place in the 200-BP-11 Operable Unit in support of the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a). In August and September 1989, Phase 1 (WHC 1991b) sediment/surface soil samples were taken from the main pond (excluding the overflow pond); the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds; and the 216-B-3-3 Ditch. In 1992, Phase 2 surface/sediment soil samples were taken to provide confirmation of Phase 1 data in the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. In 1989 and 1990, Phase 3 sampling explored the extent of contamination in the vadose zone beneath the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. These three phases of sampling effectively characterized dangerous waste in the surface and subsurface (vadose zone) soils in the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. The laboratory results from these three sampling phases are provided in the *216-B-3 Expansion Ponds Closure Plan*, Appendices C, D, and E (DOE-RL 1993b). The results from the Phase 1, 2, and 3 sampling events are summarized in the following sections.

3.2.1 Phase 1 Data Summary

Phase 1 surface soil characterization (WHC 1991b) data provide a complete set of dangerous waste constituent information and a limited amount of radionuclide information for the 216-B-3 Main Pond (excluding the overflow pond); the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds; and the 216-B-3-3 Ditch. Although Phase 1 data have not been validated (and are not expected to be), they are considered a reliable source for the determination of known and suspect contamination. The sampling locations and the complete set of Phase 1 sampling analytes, analyses, and analytical results are provided in the *Phase 1 Characterization of the 216-B-3 Pond System,* WHC-SD-EN-AP-042 (WHC 1991b). Below is a summary of the Phase 1 analytical results.

3.2.1.1 Metals. The metals analyzed for Phase 1 soil sampling were aluminum, *antimony, *arsenic, *barium, *beryllium, boron, *cadmium, calcium, *chromium, *cobalt, *copper, iron, *lead, lithium, magnesium, manganese, *mercury, molybdenum, *nickel, potassium, *selenium, silicon, *silver, sodium, strontium, *thallium, *tin, titanium, *vanadium, *zinc, and zirconium.

Asterisked (*) metals are on the EPA groundwater monitoring list for TSD facilities, 40 CFR 264 (EPA 1989c, Appendix IX).

The nonasterisked metals are common to most soils and are easily combined with other soil components. Additionally, these metals are usually found in concentrations less toxic than other metals. For these reasons, these metals have been omitted in the *Groundwater Monitoring List*, 40 CFR 264 (EPA 1989c, Appendix IX). These elements are naturally occurring in rock-forming minerals that eventually weather to become components of the soil. All the concentrations of the nonasterisked metals were found to be within normal soil concentration ranges and pose little threat for human, animal, or plant health.

From the list of metals from the groundwater monitoring list, only cadmium, lead, and mercury were found in concentrations exceeding the threshold value. The threshold value is defined as the upper concentration for common ranges in soils, the background level in the 216-E-28 Contingency Pond (sampled during Phase 1), or the contract detection limit for the specific analyte.

Cadmium was found in concentrations exceeding the threshold value (8.23 $\mu g/g$) in the 216-B-3 Main Pond, 216-B-3A Expansion Pond, and the 216-B-3-3 Ditch. Twenty-one of the thirty samples taken from the 216-B-3 Main Pond were above the threshold value. One of eight samples taken from the 216-B-3A Expansion Pond was above the threshold value. Three of the fifteen samples taken from the 216-B-3-3 Ditch were above the threshold value.

Lead was found in concentrations exceeding the threshold value only in the 216-B-3 Main Pond. Twenty-one of the thirty samples taken from the pond were above the threshold value.

Mercury was found in concentrations exceeding the threshold value in the 216-B-3 Main Pond and the 216-B-3-3 Ditch. Twenty-two of the thirty samples taken from the 216-B-3 Main Pond were above the threshold value. Three of the fifteen samples taken from the 216-B-3-3 Ditch were above the threshold value (WHC 1991c).

3.2.1.2 Ions. The ions analyzed for Phase 1 soil sampling were ammonium, bromide, chloride, cyanide, fluoride, nitrate, nitrite, phosphate, sulfate, and sulfide.

Ammonium compounds were among those known to have been disposed to the 200-BP-11 Operable Unit. However, because of their solubility, it is doubtful that these contributed to any elevated levels in present-day sediments at the operable unit. The maximum concentration of ammonium found in Phase 1 samples was 16.2 $\mu g/g$. This concentration does not appear abnormally high for sediment.

All bromide results were below the 1.0 $\mu g/g$ Contract-Required Detection Limit (CRDL). Chloride was the second most frequently detected anion behind sulfate. It does not appear that chloride is of environmental significance. The highest levels were actually found in samples from the dry, unused 216-E-28 Contingency Pond.

All cyanide measurements were below their respective CRDL (0.5 $\mu g/g$ soil, 10 $\mu g/L$ water).

Virtually all fluoride data were below the CRDL (1.0 $\mu g/g$ soil). One sample from the 216-B-3-3 Ditch had a concentration of 1.3 $\mu g/g$. Fluoride is not at hazardous levels in the near-surface soils and sediments at B Pond.

No analyses showed concentrations of nitrate or nitrite greater than the threshold value.

All phosphate data were below the CRDL of 2.0 $\mu g/g$ soil, and no observed concentrations were greater than the threshold values at the site. Phosphate should no longer be an analyte of concern in the near-surface soils and sediments of B Pond.

The highest sulfate concentration of 208.8 $\mu g/g$ was located in B Pond. However, this value is less than half the average background value of sulfate (445.3 $\mu g/g$) found in the unused 216-E-28 Contingency Pond.

For sulfide, only two samples were above the CRDL (10 μg/g). One sample from the 216-B-3A Expansion Pond was reported at 25.7 μg/g, and one sample from the 216-B-3C Expansion Pond was reported at 10.9 μg/g. All water samples analyzed for sulfide were reported below the CRDL (1 μg/mL). The data are not extensive, but do not indicate dangerous concentrations of sulfide. It is a naturally occurring compound in pond sediments and would be consistent with observed concentrations of sulfate in excess of that observed from the sagebrush sites.

3.2.1.3 Organics. The organics analyzed for Phase 1 soil sampling were chlorinated herbicides, chloropesticides, phosphorous pesticides, polychlorinated biphenyls (PCBs), semivolatile organics, and volatile organics.

Chlorinated herbicides analyzed included 2,4-D, 2,3,5-T, and 2,4,5-TP (Silvex). All composite samples were tested for these herbicides. None of the herbicides were present in any of the samples. The CRDLs were 1.0 μg/g for each analyte in soil samples and 2.0 μg/L in water. Phase 1 data do not contradict that the site is clean with respect to the aforementioned herbicides, but the analytical evidence is not conclusive. The volume of water passing through the system and the fact that chlorinated herbicides were not disposed to the site lend little support to the presence of these herbicides in the pond sediments.

Chloropesticides analyzed include endrin, methoxychlor, toxaphene, alpha benzene hexachloride (BHC), beta BHC, gamma BHC, delta BHC, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, heptachlor, heptachlorepoxide, kepone, dieldrin, aldrin, chlorodane, endosulfan alpha, endosulfan beta, endosulfan sulfate, and chlorobenzilate. Phase 1 data support the initial perception that the chloropesticides are not a serious constituent of concern in the soil and sediments of the B Pond System.

Phosphorous pesticides analyzed include tetraethylpyrophosphate, carbophenothion, disulfoton, dimethoate, methylparathion, parthion, and phorate. The soil CRDL was 1.0 μg/g for all except dimethoate, which was 2.0 μg/g. Water CRDLs were 2.0 μg/g for all compounds. No compound was reported at or above its respective CRDL. Phase 1 sampling analyses confirmed that the above phosphorus pesticides are not constituents of concern in the sediments of the B Pond System.

Polychlorinated biphenyls tested for included Arochlors (a trademark of the Monsanto Chemical Company) 1016, 1221, 1232, 1242, 1248, 1254, and 1260. The minimum CRDL for soil is 1.0 μg/g, and the minimum for water is 1.0 μg/L. All sample analyses were reported as less than their respective detection limits.

Of the 164 semivolatile organics analyzed, Bis(2-ethylhexyl)phthalate, a common laboratory contaminant (a plasticizer), was the only compound identified for either soil, sediment, or water analyses. It was identified in three samples at 2.4 μg/g, 3.5 μg/g, and 6.7 μg/g. All three results are considered qualified nondetects due to associated blank contamination at 8.0 μg/g. There is no indication that any of the long list of semivolatiles analyzed should be constituents of concern in the near-surface sediments of the B Pond System.

Of the 67 volatile organics analyzed, those found were generally insignificant. Acetone was present in more samples than any other organic compound. With the exception of one sample, all other compounds found were below the practical quantitation limit guidelines of EPA (EPA 1986).

3.2.1.4 Radionuclides. The radionuclide analytes for Phase 1 sampling were gross alpha, gross beta, strontium-90, gamma activities (sodium-22, potassium-40, cobalt-60, zirconium-95/niobium-95, ruthenium-106, cesium-134, cesium-137, and cerium-144/praseodymium-144).

The data on gross alpha, gross beta, strontium-90 concentration, and gamma show very low values. The highest observed gross beta measurement of 718 pCi/g was from a 216-B-3C Expansion Pond sample. However, this number is of relatively little value because it does not provide specific radionuclide information. The highest gamma activities in soil (in picocuries per gram) were strontium-90 (4.03); sodium-22 (0.21); potassium-40 (19.7); cobalt-57 (0.33); cobalt-60 (2.84); zirconium-95 (0.05); zirconium/niobium-95 (0.47); niobium-95 (0.15); ruthenium-106 (nondetect); cesium-134 (0.31); cesium-137 (290.00); cerium-144 (2.25); cerium/praseodymium-144 (10.50); lead-212 (0.92); and lead-214 (0.75).

3.2.2 Phase 2 Data Summary

Phase 2 surface/soil soil sampling was performed to provide confirmation of Phase 1 sampling data in the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. Confirmation was necessary because the Phase 1 analyses were not validated. The complete list of Phase 2 sampling analytes and analytical methods are provided in *Review of Phase 2 Characterization of the 216-B-3A, -3B, and -3C Expansion Ponds*, WHC-SD-EN-AP-137 (WHC 1993b). Phase 2 characterization results effectively validated Phase 1 sampling analytical results. A brief summary of Phase 2 analytical results follows.

3.2.2.1 Metals/Inorganics. Only copper, lead, zinc, antimony, and cadmium were found in concentration exceeding the Hanford Site soil background threshold (DOE-RL 1992). Except for lead, these analytes were then compared to the local area background determined during the Phase 1 study, common concentrations found in soils, and to Model Toxics Control Act (MTCA) Method B cleanup levels. Lead was compared to the more stringent Method A cleanup level. It was concluded that none of these analytes are present in concentrations of concern.

3.2.2.2 Ions. No ions were analyzed in Phase 2 samples.

3.2.2.3 Organics. No volatile organic compounds were detected in any of the water samples. The only compounds of significance found in soil samples were toluene, methylene chloride, and acetone. These three compounds are considered to be common laboratory contaminants and, with the exception of two toluene results, were found only in very low concentrations. When compared to the MTCA cleanup levels, WAC-173-340 (3), all reported values for the three compounds are significantly below cleanup levels.

No semivolatile organic compounds were detected in any of the soil samples. All semivolatile organic compounds found in the water samples were at very low levels.

No pesticides or PCBs were detected in any samples.

3.2.2.4 Radionuclides. Radionuclide analyses were performed on several samples but have not been summarized to date. It is anticipated that the analyses will be summarized and included with the Field Investigation Report (Volume 2) of this document.

3.2.3 Phase 3 Data Summary

The objective of Phase 3 characterization sampling was to collect data to evaluate potential dangerous waste contamination in the vadose zone beneath the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. The complete list of Phase 3 sampling analytes and analyses is provided in the *Vadose Zone Investigation of the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds*, WHC-SD-EN-AP-104 (WHC 1992b). A brief summary of Phase 3 analytical results follows.

3.2.3.1 Inorganics (Metals and Ions). The Phase 3 list of inorganic analytes are identical to those of Phase 1 excluding lithium, strontium, tin, titanium, zirconium, bromide, nitrite, and phosphate. Metal analytes detected were compared to the Hanford Site Background, local background levels (from Phase 1 sampling), and health-based standards. Of the analyses that showed levels above detection limits, none are considered to indicate contamination relative to local background levels.

Beryllium results were reported at levels that exceeded the MTCA Method B cleanup standards but below the Hanford Site Background threshold value. Based on the regional beryllium background concentration and the limited number of sample data, there is insubstantial evidence to conclude that the Expansion Ponds contain regulated levels of beryllium.

3.2.3.2 Organics. The organic analytes detected were dismissed as contaminants in the vadose zone because of their low concentrations and status as common laboratory contaminants.

3.2.4 Summary of Known Unplanned Release Data

Six known unplanned releases may have affected the 200-BP-11 Operable Unit and are described in Section 2.1.5. The pertinent contamination data resulting from these releases are summarized below. Note that some of the releases occurred outside the operable unit but are mentioned because they may have contributed contamination to the operable unit.

Unplanned Release UPR-200-E-32 released approximately 5,000,000 L of water contaminated with about 30 Ci of cerium-144 and 0.05 Ci of strontium-90 to the 216-B-2-1 Ditch (200-BP-8 Operable Unit). This release is likely to have affected the 216-B-3-1 Ditch and the 216-B-3 Main Pond, but the extent of contamination that reached these units is not known.

Unplanned Release UPR-200-E-34 released approximately 2,500 Ci of mixed fission products to the 216-B-3-1 Ditch and 216-B-3 Main Pond (and overflow pond). This release was a major source of radioactive contamination to the ditch and resulted in its ultimate deactivation.

Unplanned Release UPR-200-E-51 released approximately 51 kg of cadmium nitrate to the 216-B-3-3 Ditch and main pond (and overflow pond).

Unplanned Release UPR-200-E-138 released approximately 1,000 Ci of strontium-90 to the 216-B-2-2 Ditch (200-BP-8 Operable Unit). This release is likely to have contributed contamination to the 216-B-3-2 Ditch and main pond (and overflow pond). The 216-B-2-2 and 216-B-3-2 Ditches were closed as a result of this release.

3.2.5 WHC Operational Environmental Monitoring

Wastewater from chemical processing plants and other facilities is sampled by the WHC Operational Environmental Monitoring Program (OEMP) at the point of discharge to ensure compliance with WHC internal standards and applicable DOE standards. As an additional operational check, the WHC OEMP also collects surface water, vegetation, and sediment samples from the active ditches and ponds, which included the ditches and ponds from the 200-BP-11 Operable Unit. The majority of the data collected for 200-BP-11 is summarized in the B Plant AAMS Report (DOE-RL 1993c). Currently, the 216-B-3C Expansion Pond is the only active waste management unit in 200-BP-11 being sampled under the WHC OEMP.

The surface water samples collected from the OEMP were composited and analyzed monthly for gross alpha, gross beta, gamma-emitting radionuclides, and strontium-90. Additionally, the surface water was analyzed for pH, nitrate, and tritium. Samples of aquatic vegetation were collected from the ponds and ditches yearly to determine root uptake of radionuclides from potentially contaminated sediments. Along with vegetation samples, sediment samples were collected to measure the accumulation of radionuclides. The sediment samples consist of a composite of five plugs, each 900 cm^2 by 2.5 cm deep. The vegetation and sediment samples were analyzed for gamma-emitting radionuclides, strontium-90, plutonium-239, and uranium.

The results from the WHC OEMP analyses confirm that radionuclides have been disposed to the operable unit. However, the analyses do not provide information regarding the extent of contamination in the soils and therefore will not be considered further in the RFI/CMS for the 200-BP-11 Operable Unit.

3.3 POTENTIAL IMPACTS TO HUMAN HEALTH AND THE ENVIRONMENT

This section summarizes the information needed to support a qualitative and quantitative evaluation of the human health and environmental hazards as provided in Section 4.2 of the B Plant AAMS Report (DOE-RL 1993c). The AAMS report assessment includes a discussion of release mechanisms and potential transport pathways; develops a conceptual model of human exposure based on these pathways; and presents the physical, radiological, and toxicological characteristics of the known or suspected contaminants. The AAMS report assessment of environmental risks was severely constrained by the relative lack of data regarding potentially exposed biotic populations and exposure pathways. The most important data for this work/closure plan are the conceptual model and potential contaminants of concern to the operable unit.

3.3.1 Conceptual Model

Contaminants were intentionally and unintentionally released to the environment in the 200-BP-11 Operable Unit. The release mechanisms and transport pathways are discussed in Sections 4.2.1 and 4.2.2 of the B Plant AAMS Report (DOE-RL 1993c).

Figure 3-2 presents a graphical summary of the physical characteristics and mechanisms at the Hanford Site that could potentially affect the generation, transport, and impact of contamination in the 200-BP-11 Operable Unit on humans and biota (conceptual model).

There are four exposure routes by which humans (offsite and onsite) and other biota (plants and animals) can be exposed to contaminants released in the operable unit.

- Inhalation of airborne volatiles or fugitive dust with adsorbed contamination
- Ingestion of fugitive dust, surface soils, biota (either directly or through the food chain), or groundwater
- Direct contact with the waste materials (such as those exhumed by burrowing animals), contaminated surface soils, sediment, or plants
- Direct radiation from waste materials, surface soils and sediment, or fugitive dust.

The conceptual model is discussed in more detail in Sections 4.2.3 and 5.2 of the B Plant AAMS Report (DOE-RL 1993c).

3.3.2 Potential Contaminants of Concern

Candidate potential contaminants of concern for the 200-BP-11 Operable Unit are identified in Table 3-1. This list is a compilation of contaminants listed in the B Plant AAMS Report (DOE-RL 1993c). Note that this list also includes all the contaminants identified in the *216-B-3 Pond System Closure/Postclosure Plan* (DOE-RL 1990a). Additionally, as a conservative measure, candidate potential contaminants of concern listed in the PUREX Plant AAMS Report (DOE-RL 1993f) that were not listed in the B Plant AAMS Report were added to Table 3-1. The chemicals and radionuclides listed in Table 3-1 were selected based on their known usage in process streams, presence in waste, disposal in waste management units, historical association, or detection in environmental media at the B Plant Aggregate Area. Thus, for the 200-BP-11 Operable Unit, the list of candidate contaminants is considered a conservative list because most of these contaminants would not have been disposed to the operable unit in any appreciable quantity.

As discussed in the B Plant AAMS Report (DOE-RL 1993c, p. 4-62), the list of candidate contaminants was shortened by removing short-lived radionuclides, chemicals with no known carcinogenic or toxic effects, and progeny radionuclides that will not build to more than 1% of the parent activity within 50 years. However, during the DQO process discussed in Section 4.2.1, Ecology expressed uncertainty regarding discharges to the facility and requested that the candidate contaminants be compared to the Discarded Chemical Products List in WAC 173-303-9903 (Ecology 1989) and the Groundwater Monitoring List (Appendix IX) of 40 CFR 264 (EPA 1989c). At the request of Ecology, candidate contaminants found in both Table 3-1 and the Discarded Chemical Products List and/or the Groundwater Monitoring List were included as potential contaminants of concern for the 200-BP-11 Operable Unit. The contaminants reinstated as a potential concern are potassium, selenium, acetic acid (acetate), formaldehyde, naphthalene, and 1,1,2-trichloroethane.

The final list of potential contaminants of concern for the 200-BP-11 Operable Unit is provided in Table 3-2 under the "Recommended by AAMS Report" column. Thorium-228 has been added to Table 3-2 because it is the parent of the lead-212 isotope and is easily analyzed. Tin-126 has also been added because it is the parent of the antimony-126 and -126m isotopes. The radionuclide list in the "Recommended by AAMS Report" column in Table 3-2 was shortened based on decay chains, their correlation to other radionuclides, and/or known concentrations in Hanford Site processing streams. These decay chains and correlations are provided in the footnotes of Table 3-2. The shortened list of potential contaminants of concern is listed in the "Selected for 200-BP-11" column in Table 3-2.

The majority of the potential contaminants of concern selected by this work/closure plan will be analyzed directly. However, many radionuclides will be excluded from analyses because their concentrations can be assessed from other short-lived parent or daughter concentrations. These radionuclides are listed in the "Indirect Analysis" column of Table 3-2. The final target analyte list presented in Table 5-7 is derived from the "Direct Analysis" column of Table 3-2.

3.4 CORRECTIVE MEASURE REQUIREMENTS

The *Superfund Amendments and Reauthorization Act of 1986* amended CERCLA by requiring that all applicable or relevant and appropriate requirements (ARARs) be employed during implementation of a hazardous waste management cleanup. This work/closure plan will follow the same strategy with the CMRs.

The CMRs focus on federal and state statutes, regulations, criteria, and guidelines. Also included in the evaluation were DOE orders that carry out authority granted to the DOE by the Atomic Energy Act. The DOE orders are considered potential "to-be-considered" (TBC) criteria. The TBC criteria are other federal and state criteria, advisories, and regulatory guidance that are not promulgated regulations, but are to be considered in evaluating alternatives. The B Plant AAMS Report (DOE-RL 1993c) evaluates contaminant-, location-, and action-specific CMRs.

Contaminant-specific CMRs are usually health- or risk-based numerical values or methodologies that, when applied to unit-specific conditions, result in the establishment of numerical contaminant values that are generally recognized by the regulatory agencies as reasonable to protect human health and the environment. In the case of the 200-BP-11 Operable Unit, contaminant-specific CMRs address chemical constituents and/or radionuclides. The potential contaminant-specific CMRs that were evaluated for the 200-BP-11 Operable Unit are discussed in Section 6.2 of the B Plant AAMS Report (DOE-RL 1993c).

The potential location-specific CMRs that were evaluated for the 200-BP-11 Operable Unit are discussed in Section 6.3 of the B Plant AAMS Report (DOE-RL 1993c). The potential action-specific CMRs that were evaluated are discussed in Section 6.4 of the B Plant AAMS Report (DOE-RL 1993c).

A full assessment of CMRs will be performed in Volume 3 of this document after the field investigation has been completed and evaluated.

3.5 PRELIMINARY CORRECTIVE MEASURE OBJECTIVES AND ALTERNATIVES

The preliminary corrective measure (remedial action) technologies are described in Chapter 7.0 of the B Plant AAMS Report (DOE-RL 1993c). In the AAMS report preliminary RAOs, general response actions, remedial technologies, and potential corrective measure alternatives were identified based on contaminants of concern, potential routes of exposure, and potential CMRs. The overall objective of Chapter 7.0 was to identify viable and innovative remedial action alternatives for each medium of concern. Chapter 5.0 of this work/closure plan also discusses corrective measures development, screening, and analysis. These corrective measure alternatives are general and cover a broad range of actions. The preliminary remedial action alternatives will be used to focus the range of alternatives evaluated in unit-specific CMSs. The preliminary alternatives were also developed to help identify additional unit-specific information that would be needed to complete an alternative development and evaluation. This additional information will be gathered through site field investigations or treatability studies.

Figure 3-1. Current Flow Routes from Facilities Discharging to the 200-BP-11 Operable Unit.

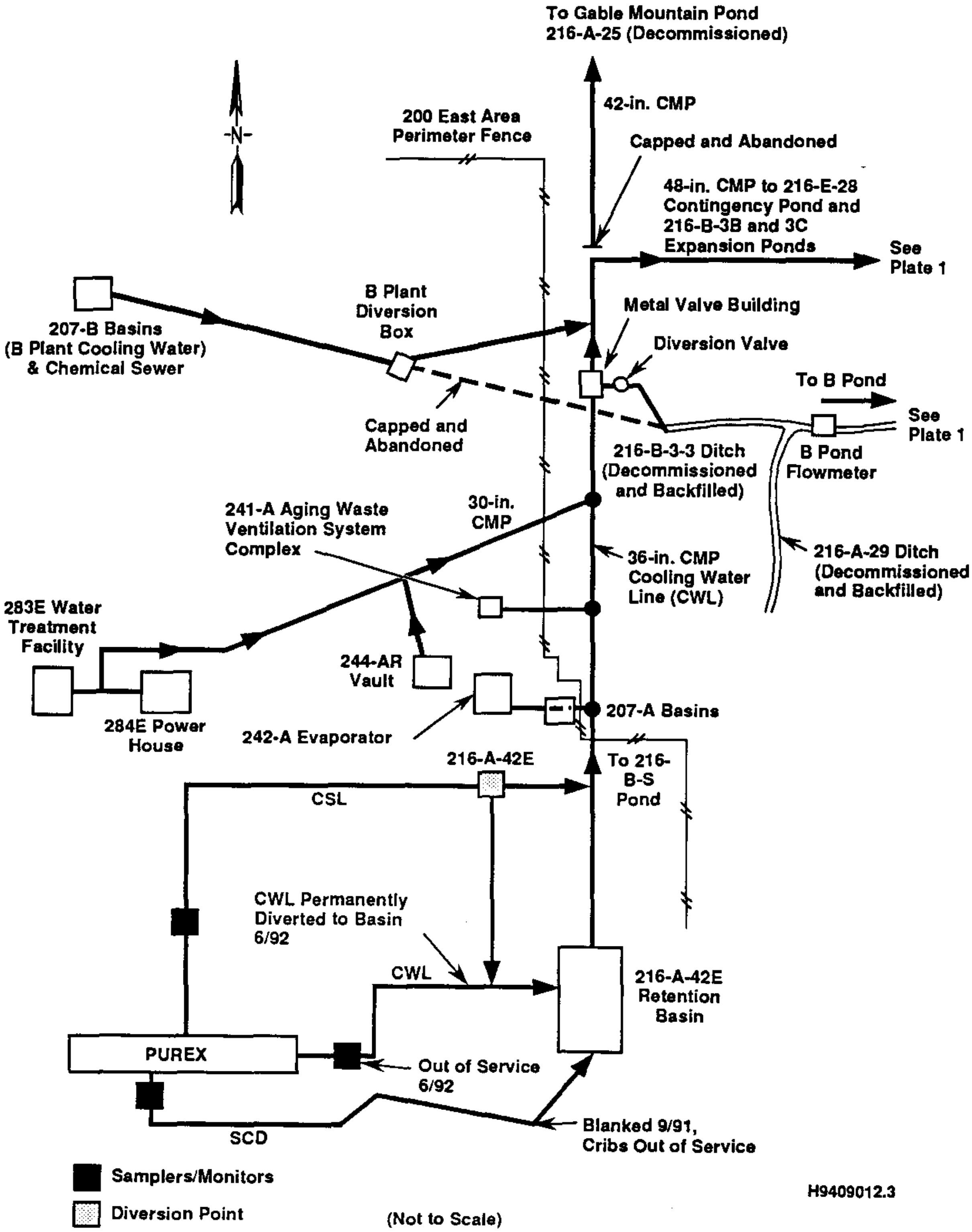

Figure 3-2. Conceptual Model Flowchart of the 200-BP-11 Operable Unit.

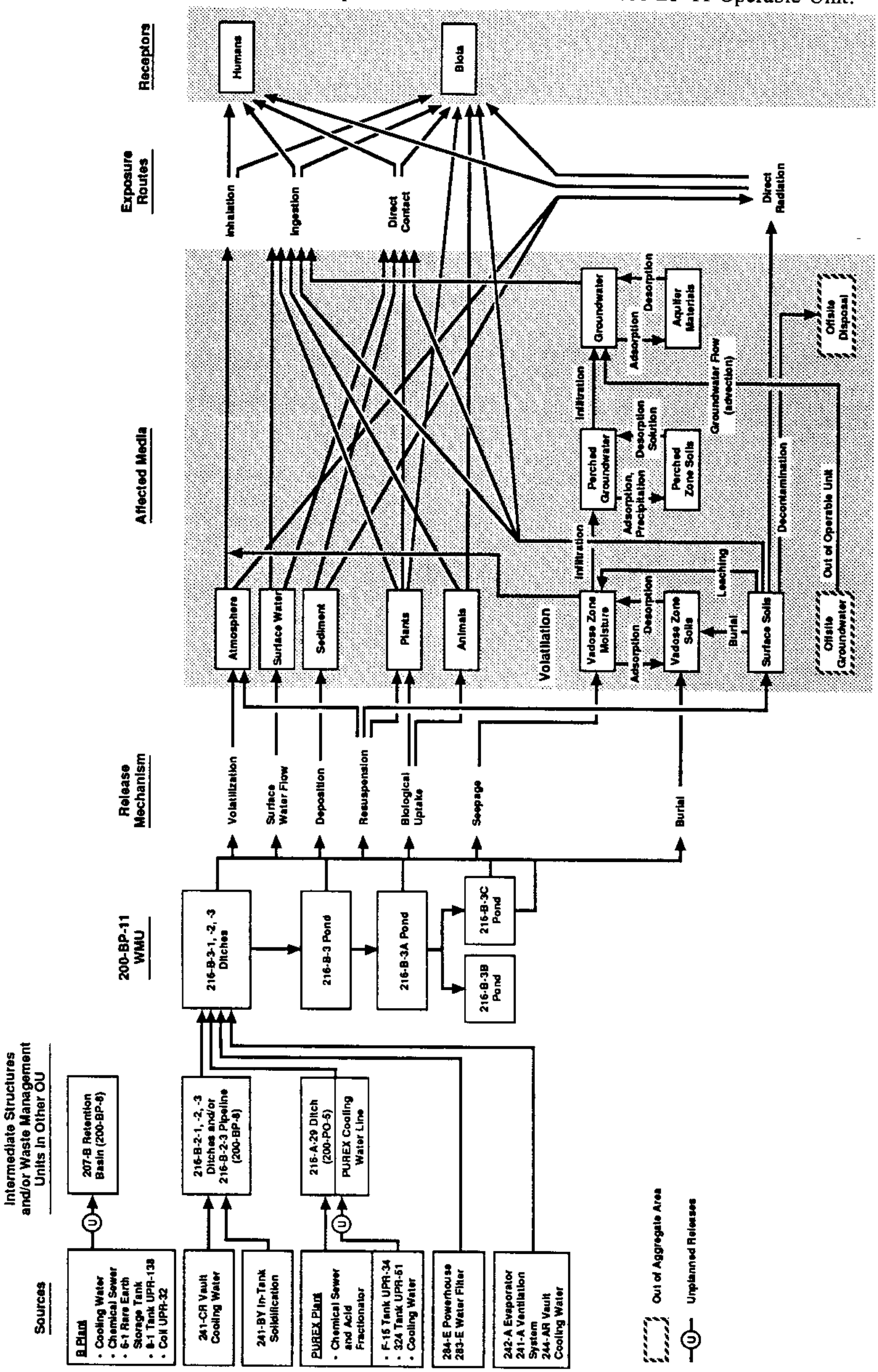

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Table 3-1. Candidate Potential Contaminants of Concern for the 200-BP-11 Operable Unit. (sheet 1 of 3)

RADIONUCLIDES

Gross Alpha
Gross Beta

TRANSURANICS

Americium-241
Americium-242
Americium-242m
Americium-243
Curium-242[a/]
Curium-244
Curium-245
Neptunium-237
Neptunium-238[a/]
Neptunium-239[a/]
Plutonium-238
Plutonium-239/240
Plutonium-241
Plutonium-242

URANIUM

Uranium-233
Uranium-234
Uranium-235
Uranium-236
Uranium-238

FISSION PRODUCTS

Actinium-225
Actinium-227
Actinium-228[a/]
Antimony-126[a/]
Antimony-126m[a/]
Astitine-217
Barium-135m[a/]
Barium-137m
Barium-140[a/]
Beryllium-7
Bismuth-210
Bismuth-211
Bismuth-212[a/]
Bismuth-213
Bismuth-214
Carbon-14
Cerium-141[a/]
Cerium-144[a/]
Cesium-134
Cesium-135
Cesium-137
Cobalt-57[a/]
Cobalt-58[a/]
Cobalt-60
Europium-152
Europium-154
Europium-155
Francium-221
Francium-223[a/]
Gadolinium-152
Iodine-129
Iron-59[a/]
Lanthanum-140[a/]
Lead-209
Lead-210
Lead-211
Lead-212[a/]
Lead-214
Manganese-54[a/]
Nickel-59
Nickel-63
Niobium-93m
Niobium-95[a/]
Niobium-95m[a/]
Palladium-107
Polonium-210
Polonium-211[a/]
Polonium-212[a/]
Polonium-213
Polonium-214
Polonium-215
Polonium-216[a/]
Polonium-218
Potassium-40
Praeseodymium-144[a/]
Praeseodymium-144m[a/]
Promethium-147
Protactinium-231
Protactinium-233[a/]
Protactinium-234[a/]
Protactinium-234m
Radium
Radium-223
Radium-224[a/]
Radium-225
Radium-226
Radium-228
Radon-219
Radon-220[a/]
Radon-222
Rhodium-103[a/]
Rhodium-103m[a/]
Rhodium-106[a/]
Ruthenium-103
Ruthenium-106
Samarium-147
Samarium-151
Selenium-79
Silver-110[a/]
Silver-110m[a/]
Sodium-22
Strontium-85[a/]
Strontium-89[a/]
Strontium-90
Technetium-99
Tellurium-129
Thallium-207
Thallium-208[a/]
Thallium-209
Thorium-227
Thorium-228
Thorium-229
Thorium-230
Thorium-231
Thorium-232
Thorium-233[a/]
Thorium-234
Tin-113
Tin-126[a/]
Tritium
Yttrium-90
Yttrium-91[a/]
Zinc-65[a/]
Zirconium-93
Zirconium-95[a/]

INORGANIC CHEMICALS

Acetic acid
Alkaline liquids
Aluminum
Aluminum nitrate (mono basic)
Aluminum nitrate nonahydrate
Ammonia (anhydrous)
Ammonium carbonate
Ammonium fluoride
Ammonium hydroxide
Ammonium ion

Table 3-1 Candidate Potential Contaminants of Concern for the 200-BP-11 Operable Unit. (sheet 2 of 3)

INORGANIC CHEMICALS (cont.)

Ammonium nitrate
Ammonium oxalate
Ammonium silicofluoride
Ammonium sulfate
Ammonium oxalate
Ammonium silicofluoride
Ammonium sulfate
Ammonium sulfite
Antifreeze (Ethylene Glycol)
Arsenic
Barium
Barium nitrate
Beryllium
Bismuth
Bismuth nitrate
Bismuth phosphate
Boric acid
Boron
Cadmium
Cadmium nitrate
Calcium
Calcium carbonate
Calcium chloride
Carbon dioxide
Carbonate
Ceric fluoride
Ceric iodate
Ceric nitrate
Ceric sulfate
Cerium
Cesium carbonate
Cesium chloride
Chloride
Chromium
Chromium nitrate
Chromous sulfate
Copper
Cyanide
Dow Anti-Foam B
Duolite ARC-359 (IX Resin) (sulfonated phenolic)
Ferric cyanide
Ferric nitrate
Ferrous sulfamate
Ferrous sulfate
Fluoride
Hydrobromic acid
Hydrochloric acid
Hydrofluoric acid
Hydrogen
Hydrogen fluoride
Hydrogen peroxide
Hydroiodic acid
Hydroxide
Hydroxyacetic acid
Hydroxylamine hydrochloride
Hyflo-Super-Cel (contains silica)
Iron
Lanthanum fluoride
Lanthanum hydroxide
Lanthanum nitrate
Lanthanum-neodynium nitrate
Lead
Lead nitrate
Lithium
Magnesium
Magnesium carbonate
Magnesium nitrate
Manganese
Mercuric nitrate
Mercury
Misc. toxic process chemicals
Nickel
Nickel nitrate
Niobium
Nitrate
Nitric acid
Nitrite
Normal paraffin hydrocarbon
Oxalic acid
Periodic acid
Phosphate
Phosphoric acid
Phosphorous pentoxide
Phosphotungetic acid
Plutonium fluoride
Plutonium nitrate
Plutonium peroxide
Potassium
Potassium carbonate
Potassium ferrocyanide
Potassium fluoride
Potassium hydroxide
Potassium oxalate
Potassium permanganate
Plutonium-lanthanum fluoride
Plutonium-lanthanum oxide
Rubidium
Selenium
Silica
Silicon
Silicon trioxide
Silver
Silver nitrate
Sodium
Sodium aluminate
Sodium bismuthate
Sodium bisulfate
Sodium bromate
Sodium carbonate
Sodium citrate
Sodium dichromate
Sodium ferrocyanide
Sodium fluoride
Sodium gluconate
Sodium hydroxide
Sodium nitrate
Sodium nitrite
Sodium persulfate
Sodium phosphate
Sodium sulfate
Sodium thiosulfate
Strontium
Strontium carbonate
Strontium fluoride
Strontium sulfate
Sulfamic acid
Sulfate
Sulfuric acid
Tartaric acid
Thorium
Tin
Titanium
Tungsten
Uranium
Uranium oxide
Uranyl nitrate hexahydrate
Vanadium
Various acids
Yttrium
Zeolon
Zinc

Table 3-1. Candidate Potential Contaminants of Concern for the 200-BP-11 Operable Unit. (sheet 3 of 3)

INORGANIC CHEMICALS (cont.)

Zirconium
Zirconium oxide
Zirconyl nitrate

ORGANIC CHEMICALS

1-Butanol
2-Butanone
Acetone
Bismuth phosphate
Butanoic acid
Butyl alcohol
Butylated hydroxy toluene
Carbon tetrachloride
Cesium phosphotungetic salts
Chloroform
Chloroplatinic acid
Citric acid
Decane
Di-2-ethyl hexyl phosphoric acid
Dibutyl butyl phosphonate
Dibutyl phosphate
Dichloromethane
Diesel fuel
Dowex 21 K/Amberlite XE-270 (IX Resin)
Ethanol
Ethyl ether
Flammable solvents
Formaldehyde (solution)
Glycolate
Grease
Halogenated hydrocarbons
Hydrazine
Hydroxy acetic acid-Trisodium hydroxy ethylene-Diamine triacetic acid
Hydroxylamine nitrate
Ionac A-580/Pemutit SK (IX Resin)
Isopropyl alcohol
Kerosene
Methyl ethyl ketone
Methylene chloride
Misc. toxic process chemicals
Molybdate-citrate reagent
Monobutyl phosphate
Normal paraffin hydrocarbon
Oxalate
Paraffin hydrocarbons
PCBs
Propanol
Shell E-2342 (Napthalene and paraffin)
Sodium acetate
Soltrol-170 ($ClOH_{22}$ to Cl_6H_{34}; purified kerosene)
Sugar (sucrose)
Tartaric acid
Tetrasodium ethylene diamine tetra-acetate (EDTA)
Thenoyltrifluoroacetone
Toluene
Tri-n-dodecylamine
Tributyl phosphate
Trichloroethane
Trichloromethane
Trisodium hydroxyethyl ethylene-diamine triacetate (HEDTA)
Waste paint and thinners
Zeolite AW-500 (IX Resin)

Source: B Plant and PUREX Plant AAMS Reports, Tables 4-22 and 4-32, respectively (DOE-RL 1993c, 1993f).

[a]The radionuclide has a half-life of < 1 year and, if it is a daughter product, the parent has a half-life of < 1 year, or the buildup of the short-lived daughter would result in an activity of < 1% of the parent radionuclide's initial activity.

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Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 1 of 6)

Recommended by AAMS Report	Selected for 200-BP-11	Direct Analysis	Indirect Analysis
Gross Alpha	X	X	
Gross Beta	X	X	
THORIUM/URANIUM			
Th-227	X		NOTE 1
Th-228 (see Note 5)		X	
Th-229	X		NOTE 2
Th-230	X	X	
Th-231	X		NOTE 1
Th-232	X	X	
Th-234	X		NOTE 3
U-233	X	NOTE 6	NOTE 2
U-234	X	NOTE 6	NOTE 4
U-235	X	NOTE 6	NOTE 1
U-236	X	NOTE 6	NOTE 5
U-238	X	NOTE 8	
TRANSURANICS			
Np-237	X	X	
Np-239	X		NOTE 7
Pu-238	X	X	
Pu-239/240	X	X	
Pu-241	X	X	
Pu-242	X		NOTE 8
Am-241	X	X	
Am-242	X		NOTE 8
Am-242m	X		NOTE 8
Am-243	X		NOTE 7
Cm-242	X		NOTE 8
Cm-244	X	X	
Cm-245	X		NOTE 9

Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 2 of 6)

Recommended by AAMS Report	Selected for 200-BP-11	Direct Analysis	Indirect Analysis
ACTIVATION PRODUCTS			
H-3 (Water Only)	X	X	
C-14	X		NOTE 10
Na-22	X		NOTE 11
K-40	X		NOTE 12
Ni-59	X		NOTE 13
Ni-63	X		NOTE 13
Co-60	X	X	
FISSION PRODUCTS			
Se-79	X		NOTE 10
Sr-90	X	NOTE 14	
Y-90	X		NOTE 14
Zr-93	X		NOTE 10
Nb-93m	X		NOTE 10
Tc-99	X	X	
Ru-106	X		NOTE 11
Pd-107	X		NOTE 10
Sn-126 (see NOTE 10)			NOTE 10
Sb-126	X		NOTE 15
Sb-126m	X		NOTE 15
I-129	X		NOTE 10
Cs-134	X		NOTE 11
Cs-135	X		NOTE 10
Cs-137	X	NOTE 16	
Ba-137m	X		NOTE 16
Pm-143	X		NOTE 11
Sm-147	X		NOTE 10
Sm-151	X	NOTE 17	
Eu-152	X	X	
Eu-154	X	X	

Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 3 of 6)

Recommended by AAMS Report	Selected for 200-BP-11	Direct Analysis	Indirect Analysis
Eu-155	X	X	
Gd-152	X		NOTE 12
DAUGHTER PRODUCTS			
Tl-207	X		NOTE 1
Pb-209	X		NOTE 2
Pb-210	X		NOTE 4
Pb-211	X		NOTE 1
Pb-212	X		NOTE 5
Pb-214	X		NOTE 4
Bi-210	X		NOTE 4
Bi-211	X		NOTE 1
Bi-213	X		NOTE 2
Bi-214	X		NOTE 4
Po-210	X		NOTE 4
Po-213	X		NOTE 2
Po-214	X		NOTE 4
Po-215	X		NOTE 1
Po-218	X		NOTE 4
At-217	X		NOTE 2
Rn-219	X		NOTE 1
Rn-222	X		NOTE 4
Fr-221	X		NOTE 2
Ra-223	X		NOTE 1
Ra-225	X		NOTE 2
Ra-226	X		NOTE 4
Ra-228	X		NOTE 5
Ac-225	X		NOTE 2
Ac-227	X		NOTE 1
Pa-231	X		NOTE 1
Pa-234m	X		NOTE 3

Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 4 of 6)

Recommended by AAMS Report	Selected for 200-BP-11	Direct Analysis	Indirect Analysis
HEAVY METALS			
Arsenic	X	X	
Barium	X	X	
Beryllium	X	X	
Bismuth		NOTE 18	
Cadmium	X	X	
Chromium	X	X	
Copper	X	X	
Iron	X	X	
Lead	X	X	
Manganese	X	X	
Mercury	X	X	
Nickel	X	X	
Potassium	NOTE 19	X	
Selenium	NOTE 19	X	
Silver	X	X	
Tin	X	X	
Uranium	NOTE 6	X	
Vanadium	X	X	
Zinc	X	X	
OTHER INORGANICS			
Acetic acid	NOTE 19		
Ammonia	X		X
Boron	X	X	
Cyanide	X	X	
Fluoride	X	X	
Nitrate/Nitrite	X	X	
Sulfuric Acid	X		X
VOLATILE ORGANICS			
Acetone	X	X	
1-Butanol (Butyl alcohol)	X	X	

Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 5 of 6)

Recommended by AAMS Report	Selected for 200-BP-11	Direct Analysis	Indirect Analysis
VOLATILE ORGANICS (cont.)			
2-Butanone (MEK, methyl ethyl ketone)	X	X	
Carbon tetrachloride	X	X	
Chloroform	X	X	
Ethyl ether	X	X	
Methylene chloride	X	X	
Toluene	X	X	
1,1,1-Trichloroethane	X	X	
1,1,2-Trichloroethane	NOTE 19	X	
SEMIVOLATILE ORGANICS			
Hydrazine	X		NOTE 20
Formaldehyde	NOTE 19		
Kerosene	X	X	
Napthalene	NOTE 19	X	
PCBs	X	X	
Tributyl phosphate	X	X	

NOTES:

1. Uranium-235, thorium-231, protactinium-231, actinium-227, thorium-227, radium-223, radon-219, polonium-215, lead-211, bismuth-211, and thallium-207 are decay products of the plutonium-239. Uranium-235 plus daughter's activities will never be greater than 3.5E-5 times the base activity of plutonium-239.

2. Protactinium-233, uranium-233, thorium-229, radium-225, actinium-225, francium-221, astitine-217, bismuth-213, thallium-209, polonium-213, and lead-209 are decay products of neptunium-237. Protactinium-233 plus daughter activities will never be greater than 8.2E-1 times the base activity of neptunium-237.

3. Thorium-234 and protactinium-234m are decay products of uranium-238. Thorium-234 plus daughter's activities will never be greater than 1.0E1 times the base activity of uranium-238. Additionally, the half-life of protactinium-234m is only 1.2 minutes.

4. Uranium-234, thorium-230, radium-226, radon-222, polonium-218, lead-214, astitine-218, bismuth-214, polonium-214, thallium-210, lead-210, bismuth-210, thallium-206, and polonium-210 are the decay products of plutonium-238. Uranium-234 plus daughter's activities will never be greater than 3.8E-4 times the base activity of plutonium-238.

Table 3-2. Selection Process for 200-BP-11 Contaminants of Concern. (sheet 6 of 6)

5. Uranium-236, thorium-232, radium-228, actinium-228, thorium-228, radium-224, radon-220, polonium-216. astitine-216, lead-212, bismuth-212, thallium-208, and polonium-212 are decay products of curium-244 and plutonium-240 decay chain. Uranium-236 activity will never be greater than 2.0E-3 times plutonium-240 base activity. Thorium-232 plus daughter's activities will never be greater than 2.5E-4 times the base activity of uranium-236. Thorium-228 is added to the list of potential contaminants of concern because it is a parent to lead-212 and is readily analyzed.

6. Initially, total chemical uranium will be analyzed. If total uranium exceeds 10 μg/mg, the individual isotopes will be analyzed. Uranium-238 is the primary 99+% isotope in natural uranium and still represents 98+% of the isotope in Hanford reactor fuels. The 10 μg/mg value for total uranium will yield the 3.8 pCi/g Industrial value for uranium-238 as shown in Appendix C.

7. Americium-243 decays to neptunium-239, which decays to plutonium-239. Plutonium-239 will be analyzed.

8. Plutonium-238, uranium-238, americium-242, plutonium-242, and curium-242 are decay products of americium-242m. Plutonium-238 will be analyzed. Uranium-238 will be analyzed if total uranium is found in a concentration greater than or equal to 10 μg/mg.

9. Curium-245 decays to plutonium-241, which will be analyzed.

10. Carbon-14, cesium-135, iodine-129, niobium-93m, palladium-107, samarium-147, selenium-79, tin-126, and zirconium-93 will each have an activity of less than 5.0E-5 times cesium-137 or strontium-90 in a normal fission product mixture. Tin-126 is added to the potential contaminants of concern because it is the parent of antimony-126 and -126m.

11. Sodium-22, cesium-134, ruthenium-106, and promethium-143 each have a half-life of less than 3 years, thus no parent is present to "feed" continuing ingrowth.

12. Potassium-40 and gadolinium-152 are natural occurring radioactive elements with minimal production in fission reactors.

13. Nickel-59 and -63. Nickel-59 activity is less than 5.0E-6 times cesium-137 or strontium-90 activity in Hanford reprocessing streams. Nickel-63 activity is less than 5.0E-4 times cesium-137 or strontium-90 activity in Hanford reprocessing streams.

14. Yttrium-90 is a daughter product of strontium-90 and is the isotope actually measured in the strontium-90 analysis.

15. Antimony-126 and -126m are daughter products of tin-126. Additionally, Sm-126m has a half-life of only 19 minutes.

16. Barium-137m is a daughter product of cesium-137.

17. There are currently no routine commercial analytical methods for detecting samarium-151.

18. Bismuth is not a contaminant of concern and is added only as an indicator per the request of the EPA.

19. Potassium, selenium, acetic acid, 1,1,2-trichlorethane, formaldehyde, and naphthalene are included because they are listed in both Table 3-1, "Candidate Contaminants of Concern for 200-BP-11 Operable Unit," and Table 173-303-9903 WAC, "Discarded Chemical Products List" (Ecology 1989) and/or 40 CFR 264, Appendix IX, "Groundwater Monitoring List" (EPA 1989c).

20. Hydrazine will not be analyzed due to its rapid degradation to nonhazardous constituents.

4.0 WORK PLAN APPROACH AND RATIONALE

The overall approach to the *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan* investigation is based on the process set forth in the *Hanford Past-Practice Strategy* (DOE-RL 1991b) and recommendations made in the *B Plant Source Aggregate Area Management Study Report* (DOE-RL 1993c). The Hanford Past-Practice Strategy identifies the need to accelerate the cleanup process by favoring interim cleanup activities for high-priority contaminated zones. While the 200-BP-11 Operable Unit is not a high-priority contaminated zone based on concentrations identified to date, it does retain a high prioritization for investigation to address the active RCRA TSDs scheduled for closure under the Tri-Party Agreement. The B Plant Aggregate Area Management Study (AAMS) Report (DOE-RL 1993c) initiated the implementation of the *Hanford Past-Practice Strategy* (DOE-RL 1991b) by identifying the 200-BP-11 Operable Unit for additional characterization under an LFI, as identified in Chapter 1.0. Also described in Chapter 1.0 is the integration of the past-practice work plan with the RCRA TSD unit closure/postclosure plan. As a result, the near-term strategy for the 200-BP-11 Operable Unit is to conduct a field investigation, QRA, and a CMS. The QRA and CMS will lead to decisions on corrective measures for both the RCRA TSD and RCRA past-practice units. The strategy for conducting the field investigation will be to conduct characterization of potential contaminants where existing data are considered insufficient to make decisions for determining the need for a corrective measure.

This chapter develops the rationale used to design the field program for the 200-BP-11 Operable Unit field investigation and to support characterization of the RCRA TSD unit that may undergo closure/postclosure (i.e., the 216-B-3 Main Pond and 216-B-3-3 Ditch). Another RCRA TSD unit consisting of the 216-B-3A, 216-B-3B, and 216-B-3C Expansions Ponds is being clean closed under the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b), and therefore this chapter will address only radionuclide contamination for these units. Because the operable unit contains both RCRA past-practice and RCRA TSD waste management units, different approaches to the investigation are required for the different types of units. Data are needed to refine the existing conceptual model and to conduct a QRA for past-practice units to support corrective measure determinations, as applicable, following the Hanford past-practice strategy decision-making process. Data will be evaluated following completion of the proposed investigation program to determine whether additional data are necessary to determine contaminant nature and extent and whether it is appropriate to pursue RCRA TSD unit clean closure.

Section 4.1 of this work/closure plan describes the data uses defined by the Hanford past-practice strategy, data needs described in Chapter 8.0 of the B Plant AAMS Report (DOE-RL 1993c), and data required to support closure of RCRA TSD units. Section 4.2 discusses the rationale for selecting specific field investigation activities to fill data gaps.

4.1 FIELD INVESTIGATION DATA USES AND DATA NEEDS

The field investigation will address past-practice issues for the operable unit while, at the same time, establish data that support addressing issues under an RFI for the RCRA TSD units. The field investigation, as defined in the *Hanford Past-Practice Strategy* (DOE-RL 1991b), addresses two primary data uses: refinement of the operable unit conceptual model and support of the performance of a QRA. The QRA will address past-practice units and radionuclide contaminants for all of the operable unit. While a QRA normally is not performed for TSD units, it will also include these units for the 200-BP-11 Operable Unit to maintain a consistent approach. The evaluation of contaminant distributions in the QRA will support determinations to identify potential corrective measures or other appropriate paths. The primary areas for refinement of the conceptual model are indicated in Chapter 8.0 of the B Plant AAMS Report (DOE-RL 1993c). The data needs for refinement of the conceptual model can be expressed in the following categories:

- Hydrostratigraphy
- Vadose zone properties
- Source contributions
- Nature and extent of contamination.

The QRA relies on the development of the conceptual model to conduct a preliminary human health risk assessment following the guidelines presented in the Hanford Site Baseline Risk Assessment Methodology (HSBRAM; DOE-RL 1993e) (see Section 5.1.7). Primarily, the QRA requires identification and definition of contamination in soil to help identify whether contaminated areas may be recommended for corrective measure designation. Ecological risks will be evaluated through an ecological characterization plan separate from this work plan that will address the 200 Areas as a whole. RCRA requires that the contaminant concentrations meet the MTCA Method B (WAC 173-340) residential soil cleanup standards in order to achieve clean closure of the TSD unit.

The data uses for the field investigation (refinement of the conceptual model and completion of a QRA) and corresponding general data needs for the 200-BP-11 Operable Unit are shown in Figure 4-1, along with specific data needs for each general category. Figure 4-1 also indicates the activities planned to address these needs, which are discussed in Section 4.2. All of these data needs are considered essential to fill field investigation data gaps previously identified in the B Plant AAMS Report (DOE-RL 1993c). The most important need for the corrective measures decision process is to further define the nature and extent of contamination. This need is followed in importance by the need to further define vadose zone properties. Further definition of hydrostratigraphy and source contributions are important gaps to fill, but are not the main drivers of field activities proposed in this work plan.

The B Plant AAMS Report developed specific data needs for the data uses in source operable units, as presented in Section 8.2.2 of the B Plant AAMS Report (DOE-RL 1993c). During the AAMS report process, the available data were compiled and reviewed to determine usefulness and to identify data gaps. These data gaps are derived from information presented in Chapters 2.0, 3.0, and 4.0 of the B Plant AAMS Report and are described in detail in Chapter 8.0 of the B Plant AAMS Report. General data needs identified in the B Plant AAMS Report fall into the categories shown in Figure 4-1. The general data needs are divided into two or more specific data needs that describe individual parameters or groups of parameters to be obtained in this field program. Figure 4-1 identifies the relationship between the data uses and data needs and illustrates the field activities required to obtain specific parameters necessary to fill those needs.

The relationship between data uses and general and specific data needs described herein and outlined in Figure 4-1 forms the basis for planning field and other activities to collect required data from the field investigation, as presented in Section 4.2. The data collection program is developed using a DQO process consistent with EPA guidance (EPA 1987) and with DQOs discussed in the B Plant AAMS Report (DOE-RL 1993c). The most recent EPA guidance (EPA 1993) was utilized during several DQO meetings among DOE-RL, Ecology, and EPA. Agreements reached are discussed in Section 4.2.1.

4.2 FIELD INVESTIGATION DATA COLLECTION PROGRAM

This section presents the approach and rationale used in selecting the types of field investigation data collection programs for the *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan*. The field programs and other data collection activities are derived from Chapter 8.0 of the B Plant AAMS Report (DOE-RL 1993c) using the DQO process discussed in Section 4.2.1. As discussed in Section 4.1, data needs for the work plan were identified as the primary information necessary to further develop and refine the operable unit conceptual model and to complete a QRA.

To address general data needs, Chapter 8.0 of the B Plant AAMS Report (DOE-RL 1993c) presents a data collection strategy that is applicable to the 200-BP-11 Source Operable Unit. The general investigation strategies presented in the B Plant AAMS Report include contaminant nature and extent investigation, source release investigation, and geologic investigation. This section builds on these strategies by providing the rationale and specific DQOs for the data collection program presented in Chapter 5.0. As part of the overall work plan rationale, the data collection program also focuses on providing information needed to address current data gaps associated with the conceptual model. In this way, the data collection program is designed to address work plan data needs by resolving data gap issues using the current understanding of existing physical conditions and contaminant distribution.

Section 4.2.1 summarizes the rationale for developing specific DQOs for the field and other data collection activities. Sections 4.2.2 through 4.2.4 describe the rationale associated with the DQO process for each of the data collection activities.

4.2.1 General Rationale for Developing Data Quality Objectives

The DQO process is used as a planning tool to develop a data collection strategy that is compatible with intended operable unit data needs and uses. The DQO process helps ensure that the right type and quality of data are collected to fulfill informational requirements for refining the conceptual model, completing the QRA, and ultimately for determining the status of the contaminants identified in the operable unit in accordance with the *Hanford Past-Practice Strategy* (DOE-RL 1991b) path alternatives, or in accordance to RCRA closure requirements for TSD units (WAC 173-303-610). Within this context, DQOs represent qualitative and quantitative statements and criteria used to develop the strategy for data collection and to determine the specific data parameters to be measured or collected. The DQO process was used to optimize the number and location of samples, measurements, chemical analyses, etc. necessary to satisfy the operable unit data needs, and to obtain these data at an acceptable level of uncertainty. The DQO process also helps to make data collection activities more efficient and more cost effective.

The DQO process for the *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan* involved meetings held during the period of November 1993 to March 1994 among representatives of the DOE, Ecology, and EPA. The DQO process resulted in an agreement letter among the parties that identified specific data collection activities (Appendix C). The outcome of this process is the specific activities identified in Sections 4.2.2 through 4.2.4 that are agreed to in common but subject to further review. In general, it was determined that data needs for the current evaluation will address RCRA past-practice related issues while broadening the characterization of the operable unit in support of resolving RCRA TSD related issues. The scope of the proposed field activities is designed to assess whether potential contaminants occur within the operable unit at maximum concentrations greater than MTCA Method C Soil Cleanup Levels for chemical contaminants (WAC 173-340-745) or radionuclide activities greater than HSBRAM industrial guidelines (DOE-RL 1993e). The proposed sampling scheme is a biased approach that targets locations with the highest potential for contaminant accumulations based upon the conceptual model, thereby identifying maximum concentrations through implementation of a limited field program.

Additional investigations may be conducted to refine the distribution of contaminants, as necessary. For example, if contaminant concentrations are observed to be between residential MTCA Method B and industrial MTCA Method C cleanup levels and/or radionuclides above HSBRAM levels, further sampling may be required to determine with statistical confidence whether contaminants exceed Method C industrial cleanup or HSBRAM industrial cleanup standards. In addition, RCRA unit clean closure may be pursued if chemical contaminants are below residential cleanup levels. Clean closure may be assessed through a statistical analysis of contaminants using existing data along with data from proposed activities herein. The statistical analysis may identify data gaps that should be filled in order to pursue RCRA unit clean closure.

Criteria used to define DQOs for each of the field activities listed in Figure 4-1 are detailed in Tables 4-1 through 4-4. Each table lists the investigation objectives for addressing operable unit data needs. Based on these objectives, the prioritized use of the information obtained is described in terms of site characterization issues related to refinement of the conceptual model and completion of a QRA based on the refined model. Parameters to be obtained are listed in Tables 4-1 through 4-4, along with appropriate DQO guidelines for implementing the testing method or gathering the data. Implementation guidelines for many of the field activities are expected to rely heavily on existing Environmental Investigations Instructions (EIIs) (WHC 1988b), which discuss in detail common testing methods and procedures used at the Hanford Site. Implementation guidelines for some field activities presented in the DQO tables also include reference to follow-on description of work documents that are planned to provide supplementary detail to the work plan field investigation once specific decisions have been made regarding drilling methods and other procedures.

Tables 4-1 through 4-4 also describe or reference the required parameter measurement limits and quality criteria. The DQO tables list critical values or samples for data parameters to identify in general terms the geographic areas, stratigraphic horizons, or other requirements where data are needed to address data needs or other specific data gaps in the conceptual model. Critical samples or other parameters for some field activities such as chemical analyses are prioritized with regard to the importance of the data. Constraints that may limit the data collection activity also are identified in Tables 4-1 through 4-4.

4.2.1.1 Investigation Activities and Analyses. This section summarizes the rationale for general field investigation activities and analyses developed for this work/closure plan.

4.2.1.1.1 Field Activities. Each data need has certain requirements best fulfilled by specific field activities. In addition, Figure 4-1 illustrates how each field activity generally addresses more than one data need. The proposed field activities described in Sections 4.2.2 to 4.2.4 are summarized as follows.

- Surface radiological surveys that have been conducted for normal operable unit operations or are planned to be conducted for intrusive data collection activities will be evaluated to determine if "hot spots" (radioactivity greater than twice background levels) may be identified that exhibit radionuclide activities above background values. If hot spots are identified, they may be used for refining locations of soil boring locations and determining the need for surficial soil sampling.

- Borehole geologic logging and soil sampling for laboratory analyses of physical properties will provide more data to assess operable unit stratigraphy and hydrologic properties. Selected samples will be collected to characterize subsurface soil grain size distribution, bulk density, moisture content, hydraulic conductivity, and pH.

- Soil sample collection and laboratory analysis for chemical concentrations and radionuclide activities will provide data to assess the nature and extent of contaminants in the vadose zone.

- Subsurface (borehole) geophysical surveys, especially those to obtain spectral gamma data, will support the evaluation of contamination nature and extent.

4.2.1.1.2 Analyses. Soil samples will be collected in conjunction with the activities listed above. These samples will be analyzed to assess contaminant concentration and/or to characterize physical properties. The list of analyses for these samples is derived from the LFI contaminants of concern listed in Section 3.1 (Table 3-2). Chemical analytical suites that include the contaminants of concern are radionuclides, metals, other inorganic compounds, volatile organic compounds, and semivolatile organic compounds. The properties to be measured in the physical sample suites include grain size distribution, bulk density, pH, moisture content, and unsaturated hydraulic properties. Analytes and analyses are discussed in Section 5.1.5 and the QAPjP (Appendix A).

4.2.1.2 Conceptual Model of Contaminant Distribution. A model of contaminant distribution can be used to design an effective sampling program at each unit. Based on this model, sampling efforts can be concentrated at locations and depths where contamination is expected, and fewer "confirmatory" samples need to be collected in areas where little or no contamination is expected. Previous studies at the 216-B-3 Pond Complex are the most important source of information for the models. Additional data are available from studies conducted at similar waste management units.

4.2.1.2.1 Data from Previous Studies. A large body of data describing near-surface contaminant distribution at the 216-B-3 Pond complex has already been collected (Section 3.2). In addition, several studies of horizontal and vertical contaminant distribution have been conducted at the 216-U-10 Pond Complex and BY Cribs.

216-B-3 Pond Complex. An extensive sampling program has already been conducted at the 216-B-3 Pond complex as part of the RCRA closure characterization process. During the first 2 phases of the program, surface soil samples were collected from approximately 60 locations within the ponds and from the 216-B-3-3 Ditch. Several surface soil samples were also collected outside of the ditches and ponds to establish background levels for some contaminants. During Phase 3 of the program, three borings were made through the vadose zone to groundwater, with one located at each of the overflow ponds. The samples were analyzed for an extensive suite of organic and inorganic contaminants, and for strontium-90, gross alpha, gross beta, and gamma scan.

The results of these analyses are summarized in Section 3.2 of this report. Organic and radionuclide analytes were undetected in the samples or were identified at concentrations that were below levels of concern. Inorganic analytes also generally were below levels of concern, with the exception of lead, mercury, and cadmium, which were identified at levels slightly above naturally occurring background concentrations for the 216-B-3 Pond complex.

Detected concentrations were observed at only near-background or near-detection-limit levels. Even with these low-level detections, some general conclusions can be made about contaminant distributions. Contaminant concentrations are higher in the 216-B-3 Main Pond than in the expansion ponds or the 216-B-3-3 Ditch. Within the 216-B-3 Main Pond the highest levels of mercury, lead, and cadmium are found in the central part of the pond, while the margins of the pond tend to exhibit lower contaminant concentrations. The vadose zone beneath the expansion ponds does not appear to be contaminated, and there is no evidence of deep vadose zone contamination beneath any of the other units.

Furthermore, there are 2 upgradient and 18 downgradient groundwater monitoring wells around the 216-B-3 Pond complex. The sampling results from these wells are summarized in Chapter 4.0 of the 200 East Groundwater AAMS Report (DOE-RL 1993a). Tritium is the only groundwater contaminant plume associated with the pond system. Scintillation probe profiles are available for approximately 30 wells in and around the 216-B-3 Pond complex. These data were analyzed in the B Plant AAMS Report, and no elevated gamma activity was noted within the vadose zone soils of the area (DOE-RL 1993c).

216-U-10 Pond, 216-U-14 Ditch, and 216-Z-19 Ditch. Several large-scale liquid release sites have been studied in the 200 West Area. These data can be used to model expected contaminant distributions beneath comparable sites in the 200-BP-11 Operable Unit. Vertical and horizontal contaminant distributions have been studied at the 216-U-10 Pond, the 216-U-14 Ditch, and the 216-Z-19 Ditch (the 216-U-10 Pond System).

These units are comparable to the 200-BP-11 Operable Unit ditches and ponds in several ways.

- The design and purpose of the ditches and ponds at each location are the same.

- The units both received large volumes of dilute liquid waste (1.65×10^{11} L for the 216-U-10 Pond System and 2.4×10^{11} L for the 216-B-3 Pond complex).

- Each unit received a diverse waste inventory with the same primary constituents. The most important differences in inventory are that the U Pond received more than an order of magnitude more plutonium than the B Pond, and the B Pond received almost an order of magnitude more strontium-90 and cesium-137 than the U Pond.

- Both pond complexes are underlain by the Hanford formation. The vadose zone stratigraphy for the first 30 m (100 ft) beneath both areas is dominated by interbedded gravels and sands with minor silt interbeds, although some variability in the formation exists between the 200 West Area and the 200-BP-11 Operable Unit.

Last and Duncan (1980) and Last (1983) conducted an extensive drilling and surface sampling program at the 216-U-10 Pond, the 216-U-14 Ditch, and the 216-Z-19 Ditch. Surface samples and near-surface core samples were collected throughout the 216-U-10 Pond and 216-U-11 Overflow Basin area. In situ measurements, surface samples, and near-surface [30-cm- (12-in.) deep] core samples were collected at each grid point.

Nine sampling transects, each consisting of seven sampling stations to obtain 30-cm- (12-in.) deep core samples, were established across the 216-Z-19 Ditch. In the ditch center, undisturbed cores were collected to an average depth of 76 cm (30 in). A similar sampling scheme was used along the 214-U-14 Ditch, where 12 transects were established with 5 sampling stations each. In addition, three 3-m (10-ft) test pits were recently completed across the ditch as part of an assessment of potential impacts to groundwater.

Other surface and near-surface soil samples also were collected. These were either preliminary samples taken prior to the main sampling program or supplementary samples collected after the main sampling efforts to provide refinement of the sampling results. A total of 494 surface and near-surface samples were collected from the 216-U-10 Pond and 216-U-11 Basin area, 262 samples from 216-Z-19 Ditch area and 215 samples from the 216-U-14 Ditch area.

Two vadose zone wells were drilled along 216-Z-19 Ditch to a depth of approximately 24 m (80 ft). A third monitoring well was drilled near 216-U-10 Pond to a depth of 73 m (240 ft) for groundwater monitoring purposes. Sediment samples were collected at 0.3-m (1-ft) intervals in the upper portion and at 2-m (5-ft) intervals in the lower portions of each boring. Seventeen shallow exploration borings were drilled to locate the buried 216-Z-1 and 216-Z-11 Ditches (adjacent to the 216-Z-19 Ditch), and one well was drilled in the 216-U-10 Pond delta area. The shallow borings were approximately 4 m (13 ft) deep and samples were collected approximately every 0.3 to 0.6 m (1 to 2 ft). A total of 322 subsurface soil samples were collected from these borings.

The soil samples were analyzed in the laboratory for gamma-emitting radionuclides, plutonium, americium, strontium-90, uranium, moisture content, and texture. Neutron well logging and in situ gamma energy analyses also were conducted.

The most significant radionuclides detected in the pond and ditch soil samples were cesium-137, strontium-90, americium-241, plutonium, and uranium. Contamination was localized in the upper 0.1 m (0.3 ft) of the pond sediments and dropped off rapidly with depth. Contaminant concentrations are highest in the center of the 216-U-10 Pond and in the delta region and decrease towards the old pond margins. Plutonium concentrations below the 216-Z-19 Ditch were highest in the first 30 cm (12 in.) below the ditch and were two to three orders of magnitude less at the 1-m (3-ft) depth. No plutonium was detected deeper than 14 m (46 ft) below the ditch. The highest concentrations were found immediately below inflow points into the ditch. The americium distribution beneath the ditch was similar to the plutonium distribution. Contaminant concentrations are highest at the bottom of the ditches and decrease towards the sides. The sampling results from these units are presented in Last and Duncan (1980) and Last (1983) and summarized in Section 4.1.2 of the B Plant AAMS Report (DOE-RL 1993c).

Initial results from three of the 3-m (10-ft) test pits on the 216-U-14 Ditch, located about 183 m (600 ft) east of the 216-U-10 Pond, indicate that cesium-137 and total uranium are the most common radionuclides and that the concentrations are the highest in the first 0.3 m (1 ft) below the ditch bottom.

BY Cribs. A detailed study of the vertical distribution of contaminants beneath the BY Cribs has recently been completed. The BY Cribs design consists of four vertical concrete pipes set below grade in a square pattern. The vertical pipes are 1.2 m (4 ft) in diameter and 1.2 m (4 ft) long, placed 2 m (7 ft) below grade, and set on a 1.5-m- (5-ft) thick bed of gravel. The pipes are arranged in a square with the centers spaced 4.6 m (15 m) apart in a 4.6- by 4.6- by 9-m (15- by 15- by 30-ft) deep excavation. Although the BY Cribs are very different in design from the ditches and ponds of the 200-BP-11 Operable Unit, there are many similarities between the two units. Both units received large volumes of dilute liquid waste, and the vadose zone stratigraphy is similar for the first 30 m (100 ft) beneath both units. They are both underlain by interbedded gravels and sands with minor silt interbeds of the Hanford formation. The most common radionuclides detected below the cribs were strontium-90 and cesium-137, which are two of the dominant waste constituents at the B Pond.

Drilling of the BY Cribs occurred between 1991 and 1993 with up to three borings at each crib. The preliminary field results generally indicate that contamination is concentrated directly beneath the crib infiltration gravels and decreases rapidly with depth. Radionuclide concentrations are usually less than detectable at more than 9 m (30 ft) beneath the crib. Some samples from greater depths did contain detectable radionuclide concentrations, but such samples were relatively uncommon and all were at least two or three orders of magnitude less than concentrations detected immediately beneath the cribs.

The highest activities for specific radionuclides were always measured in samples collected from directly beneath the cribs. The highest gross alpha reading was 9,279 pCi/g, and gross beta readings of more than 10,000,000 pCi/g were commonly encountered. The most common radionuclides were strontium-90 (maximum activities of more than 1,000,000 pCi/g) and cesium-137 (activities of up to 6,360,000 pCi/g). Maximum plutonium-239/240 activities seldom exceeded 1,000 pCi/g, and total uranium activities seldom exceeded 100 pCi/g in the borings.

Cyanide was the most commonly detected nonradionuclide contaminant. Cyanide was found in over half of the borings, with concentrations ranging from 1.6 to 248.5 ppm. Most of the detections occurred between 5 and 11 m (16 and 35 ft) below the ground surface and closely mimicked radionuclide distributions.

Volatile organic, semivolatile organic, and pesticide detections were much less frequent and generally occurred at concentrations near the detection limit. Inorganic concentrations were generally consistent with background soil levels reported in Hoover and LeGore (1991).

Conclusions from Previous Studies. There are several general conclusions about contaminant distributions in the 216-B-3 Pond System that can be drawn from these previous studies. Many of the following observations are associated with the tendency of most of these contaminants to sorb to fine-grained material.

- Because most of the radionuclide and much of the inorganic contaminants tend to adsorb to particulates (sediment) rather than be dissolved in water, maximum radionuclide activities and inorganic contaminant concentrations should be concentrated at the inflow points to the ponds and in the deepest parts of the ponds. The coarse particles tend to settle out at the inflow point because the effluent stream velocity has slowed, but the finer particles remain in suspension until they settle in the quieter, deeper parts of the pond. Similarly, maximum contaminant concentrations should exist at the inflow points to ditches and should decrease towards the distal end of the ditches. Mobile contaminants, such as tritium and nitrate, are not sorbed to the sediment and are transported with percolating water to the uppermost aquifer underlying the 216-B-3 Pond System.

- Due to the length of use, disposal history, and contaminant transport characteristics, contaminant concentrations should be higher in the main pond than in the expansion ponds. While waste water is held in the main pond, most suspended particles will settle out, and some dissolved contaminants will be adsorbed onto sediments at the pond bottom. Water that is discharged to the expansion ponds will thus contain lower contaminant concentrations.

- Radionuclide contamination decreases rapidly with depth as filtering of particulates and sorption to fine-grained soil particles occurs readily. The highest concentrations should occur within 2 to 3 m (7 to 10 ft) of the bottom of the pond or ditch, and concentrations should be near background levels by 20-m (65-ft) depth.

- Radionuclide contaminants should be concentrated in fine-grained horizons compared to surrounding coarse-grained horizons because they are adsorbed by fine-grained sediments.

- The maximum lateral radionuclide contaminant movement tends to occur immediately above relatively impermeable horizons.

- Inorganic and organic contaminant distribution tends to mimic radionuclide distribution.

4.2.1.2.2 General Model of Contaminant Distribution for Ditches. Figure 4-2 is a generalized schematic diagram of contaminant distribution at the ditches. Again, the majority of contaminants should be held in soils immediately beneath the bottom of each ditch, except for mobile contaminants that are transported directly to the aquifer. The highest contaminant concentrations within a ditch will tend to occur near the outfall point at the head end of the ditch. However, in the case of the 216-B-3-1 Ditch, because it opened into a wide, swampy surface area at its termination into the main pond, the majority of contaminants are conceptualized to have concentrated in the swampy area of the ditch. The swampy area of the ditch would coincide with the area referred to today as the Overflow Pond. The 216-B-3-1 Ditch operated from 1945 to 1964 and had the most severe unplanned release (UPR-200-E-34); therefore, the sediment and shallow soil underlying the ditch likely contain the highest contaminant concentrations. Contamination associated with the 216-B-3-2 Ditch is anticipated to be lower, as the ditch operated only from 1964 to 1970 and the only unplanned release it received (UPR-200-E-138) contained 10 times fewer curies than UPR-200-E-34. The 216-B-3-3 Ditch, which operated from 1970 to 1994, has the lowest contaminant levels upstream from the junction with the 216-A-29 Ditch. The only unplanned release associated with the 216-B-3-3 Ditch involved the discharge of 15 kg of cadmium nitrate.

4.2.1.2.3 General Model of Contaminant Distribution for Ponds. Figure 4-3 is a generalized schematic diagram of contaminant distribution at the main pond and the expansion lobes. The majority of contaminants should be held in soils immediately beneath the bottom of the ponds. Localized, much lower contaminant concentrations may occur in deeper fine-grained horizons. Near the surface, the highest contaminant concentrations would tend to occur near the outfall to each pond and at the center of each pond. Additional specific information about each lobe is given in the following subsections.

216-B-3 Main Pond. The 216-B-3 Main Pond has been active since 1945, so its underlying soils may have been impacted by every major waste release to the pond system. Sediments and soils below the pond would, therefore, be expected to be some of the most heavily contaminated within the entire 200-BP-11 Operable Unit. After Unplanned Release UPR-200-E-34 in 1964, a layer of bentonite clay was placed onto the bottom of the pond. The sediments below this bentonite layer may have different contaminant constituents and concentrations than those above it because of changes in waste stream inputs over time.

The surface area of the pond has varied between 8 and 19 hectares (19 and 46 acres) during its operational life, and it covered 14 hectares (35 acres) prior to deactivation and interim stabilization in 1994. Those areas on the margins of the pond that are rarely covered with water will tend to be less contaminated than the permanently inundated areas.

216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. None of these ponds were in service before 1983, so they have had a very short operational life and were not impacted by the unplanned releases during the 1960's and 1970's. Because the 216-B-3 Main Pond also acts as a settling pond, most of the particulate contaminants are removed from the water before it is discharged to these ponds. For these reasons, contaminant concentrations in the sediments and soils underlying these ponds will tend to be much lower than those observed in the main pond. This is in agreement with results of previous studies (Chapter 3.0).

4.2.1.2.4 Previous Studies Summary. Data reported in previous studies indicate that the highest potential for contaminant accumulation occurs in the following areas:

- Heads of ditches and inlets to ponds
- Sediment accumulated in ditches and ponds
- Shallow soil, with most contaminant accumulation occurring in the top few feet and generally not extending past 15 m (50 ft).

4.2.2 Ditches

The soil sampling scheme proposed for the ditches considers the existing data (Chapter 3.0) and the conceptual model (Section 4.2.1.2.2) to fill data gaps in the locations of highest potential for contaminant accumulations. As indicated above, the most probable areas of contamination include the heads of ditches, closest to the effluent source. Sample collection is designed to target shallow and intermediate intervals of the vadose zone (the deep interval is addressed by the borehole to groundwater in the 216-B-3 Main Pond). Sample depths will be to 6 m (20 ft) below the original ditch bottom for shallow test pits/auger holes and to 15 m (50 ft) for intermediate borings. Sampling of these vadose zone intervals is weighted heavily towards the shallow interval based on contaminant distributions predicted by the conceptual model (intermediate borings also provide sample collection from shallow depths).

Based on the conceptual model (Section 4.2.1), contaminant distribution is expected to be concentrated at the upstream end of each ditch. In addition, it is expected (based on the conceptual model) that the greatest concentration of contaminants will be found in the 216-B-3-1 Ditch. Sampling locations have been chosen on this basis (Figure 4-4). Test pit/auger hole samples will be used to characterize the extent of contamination immediately beneath the ditch bottoms. Boreholes will be used to characterize the intermediate vadose zone. The borehole near the confluence of the three ditches is a location most likely to have high contaminant concentrations, if present. The remaining borehole and test pit/auger hole sample locations have been chosen to bracket the length of the ditches and to cover possible releases to the 216-B-3-3 Ditch from the 216-A-29 Ditch. Sampling will be conducted to support DQOs in the 216-B-3-1, 216-B-3-2, and 216-B-3-3 Ditches. All samples will be analyzed for constituents as presented in Table 3-2. In addition, the 216-B-3-3 Ditch samples will be analyzed for a modified Appendix IX analyte list as discussed in Appendix C. Samples will be taken following interim stabilization of the 216-B-3-3 Ditch.

4.2.2.1 Surface Soil Samples. Surface soil samples will be collected, as necessary, to support refinement of the conceptual model and conduct of the QRA (Figure 4-1). Surface samples will be taken only if a designated test pit/auger hole or borehole sample location has a surface radioactivity level of twice background or sustained organic vapor readings of at least 5 ppm, as measured by field instruments. The potential locations for surface soil samples coincide with all sampling points shown in Figure 4-4, as well as other hot spots that may be identified by surface radiological surveys. If field instrument monitoring does not indicate elevated values for radioactivity and organic vapors at the surface for sample locations identified in Figure 4-4, one sample interval between a depth of 0.6 and 2 m (2 and 6 ft) from the ground surface will be collected in support of the QRA. To address soil chemical and soil radiological sampling data needs, all samples will be analyzed for the total list of constituents as presented in Table 3-2. Additionally, samples taken from the 216-B-3 Main Pond and 216-B-3-3 Ditch will be analyzed for the modified Appendix IX list discussed in Appendix C.

4.2.2.2 Test Pit/Auger Hole Samples. A total of six test pit/auger holes will be advanced to a depth of 6 m (20 ft) below the original ditch bottom to address shallow soil data needs. Sample locations are presented in Figure 4-4. Test pit or auger hole samples (as determined by anticipated subsurface radiological conditions) will be taken on all three ditches within the operable unit. Soil samples will be collected at the original ditch bottom as determined from as-built cross sections or by observations made during sampling and at depths (below the original ditch bottom) of 0.6 m (2 ft), 2 m (5 ft), 3 m (10 ft), 5 m (15 ft), and 6 m (20 ft). Samples will also be taken in areas where field screening reveals radioactivity at least twice background or organic vapor readings of 5 ppm or more. To support soil chemical and soil radiological data needs, all samples will be analyzed for the constituents presented in Table 3-2. Furthermore, samples taken from the 216-B-3 Main Pond and 216-B-3-3 Ditch will be analyzed for the modified Appendix IX list discussed in Appendix C. If the location of buried ditches is uncertain, ditch locations will be confirmed using surface geophysical methods such as ground-penetrating radar. As described in Section 4.2.2.1, one sample will be collected either at the surface if a hot spot is identified (radioactivity greater than twice background or organic vapor monitoring with sustained values above 5 ppm) or between 0.6 and 2 m (2 and 6 ft) below the current land surface to support risk assessment activities.

4.2.2.2.1 216-B-3-1 Ditch. This ditch is considered to have the highest potential for soil contamination (due to the length of operation and the occurrence of Unplanned Release UPR-200-E-34) and thereby will be investigated thoroughly. Two test pit/auger hole sample locations are planned for the 216-B-3-1 Ditch. These locations are shown in Figure 4-4. Samples are spaced evenly between two planned intermediate boreholes (at the west end and midpoint of the ditch) to provide data about horizontal and vertical extent of contamination and to refine the conceptual model.

4.2.2.2.2 216-B-3-2 Ditch. One test pit/auger hole sample location is planned for the 216-B-3-2 Ditch. This location, as shown in Figure 4-4, is located halfway along the length of the ditch. The upstream end of the ditch will be assessed by an intermediate boring located near the origin of all three ditches. The downstream end of the ditch will be assessed by a borehole located at the confluence of the 216-B-3-2 and 216-B-3-3 Ditches.

4.2.2.2.3 216-B-3-3 Ditch. Three test pit/auger hole locations are planned for the 216-B-3-3 Ditch. These are located midway between the start of the ditch and the confluence with the 216-A-29 Ditch, immediately below the confluence of the 216-B-3 Ditch and the 216-A-29 Ditch, and midway between the confluence and the end of the ditch in the 216-B-3 Pond. Sample locations are shown in Figure 4-4.

4.2.2.3 Borehole Samples. Three boreholes will be advanced in the ditches to address data needs for the intermediate vadose zone at locations shown in Figure 4-4. Borehole locations have been chosen to refine the conceptual model about the horizontal and vertical extent of contamination. Boreholes will also be used to refine knowledge of vadose zone properties in the operable unit. Location selection is based on the physical conceptual model (Section 4.2.1), which assumes that contaminant concentrations will be greatest at the upstream end of each ditch and that the greatest quantity of contaminants were discharged to the 216-B-3-1 Ditch. Two boreholes are located on the 216-B-3-1 Ditch, one at the origin of the three ditches and the other at two-thirds the ditch length to the east. The borehole on the 216-B-3-3 Ditch is located to assess influences from the 216-B-3-2 Ditch and the 16-A-29 Ditch.

Borehole soil samples will be taken at all major lithologic changes in the boreholes, or at depths of 0 m (0 ft), 0.6 m (2 ft), 2 m (5 ft), 3 m (10 ft), 6 m (20 ft), 9 m (30 ft), 12 m (40 ft), and 15 m (50 ft) below the original ditch bottom. One sample will be collected either at the surface if a hot spot is identified (radioactivity greater than twice background or organic vapor monitoring with sustained values above 5 ppm) or between 0.6 and 2 m (2 and 6 ft) below the current land surface to support risk assessment activities. Specific sampling locations will be based on anticipated lithologies and determined by the field geologist and the project manager. To support soil chemical and soil radiological data needs, all samples will be analyzed for the constituents presented in Table 3-2. To support soil physical sampling data needs, physical samples will be taken at each major lithologic change. This information will be used to refine knowledge of vadose zone hydrogeologic properties and assist in future modeling efforts. Gross gamma and radionuclide logging system (RLS) gamma borehole geophysical surveys will be conducted after installation of each temporary casing string to support borehole geophysical survey data needs.

4.2.3 Ponds

The soil sampling scheme proposed for the ponds considers the existing data (Chapter 3.0) and the conceptual model (Section 4.2.1.2.3) to fill data gaps in the locations of highest potential for contaminant accumulations. As indicated above, the most probable areas of contamination include the inlets of ponds and topographic lows. Sample collection is designed to target shallow, intermediate, and deep intervals of the vadose zone. Sample depths will be to 6 m (20 ft) below the original pond bottom for shallow test pits/auger holes, to 15 m (50 ft) below the original pond bottom for intermediate borings, and to groundwater [approximately 58 m (190 ft)] for deep borings. Sampling of these vadose zone intervals is weighted heavily towards the shallow interval based on contaminant distributions predicted by the conceptual model (intermediate borings also provide sample collection from shallow depths).

Soil sampling will be conducted to support data needs in the 216-B-3 Main Pond and 216-B-3A Expansion Pond. Existing data (Chapter 3.0) are considered sufficient for the 216-B-3B and 216-B-3C Expansion Ponds. The primary data gaps concern the vertical and horizontal extent of contamination underlying the main pond. Sampling will be done using test pit/auger hole sampling and deep borehole sampling.

Based on the conceptual model, the majority of existing contamination will probably be present in surface sediments or in the vadose zone immediately beneath the pond bottoms and, as a result, the sample design emphasizes locations at or immediately below the former pond bottoms. Deep borings are used to evaluate the vertical extent of contamination in the vadose zone for characterization purposes, with one extending through the entire vadose zone. The proposed boreholes are sited based on the conceptual model in areas where contaminants are most likely to have concentrated. All soil samples will be analyzed for constituents as presented in Table 3-2. Furthermore, samples taken from the 216-B-3 Main Pond will be analyzed for the modified Appendix IX list discussed in Appendix C. An additional sample will be taken at each location between 0.6 and 2 m (2 and 6 ft) below the present land surface to support risk assessment activities. Sampling will be conducted following interim stabilization in the 216-B-3 Main Pond.

4.2.3.1 Surface Soil Samples. Surface soil samples will be collected, as necessary, to support refinement of the conceptual model and conduct of the QRA (Figure 4-1). Samples will be taken only if a designated test pit/auger hole or borehole sample location has surface radiation at a level of at least twice background or a measured organic vapor content of 5 ppm, as measured by field instruments. The potential locations for surface soil samples coincide with all sampling points shown in Figure 4-4, with adjustments to the locations or additional samples elected to target hot spots identified by radiological surveys. If field instrument monitoring does not indicate elevated values for radioactivity and organic vapors at the surface for sample locations identified in Figure 4-4, one sample interval between a depth of 0.6 and 2 m (2 and 6 ft) from the ground surface will be collected in support of the QRA. To support soil chemical and soil radiological data needs, all samples will be analyzed for the total list of constituents as presented in Table 3-2. Furthermore, samples taken from the 216-B-3 Main Pond will be analyzed for the modified Appendix IX list discussed in Appendix C.

4.2.3.2 Test Pit/Auger Hole Samples. A total of six test pit/auger holes will be advanced to a depth of 6 m (20 ft) below the original pond bottom to address shallow soil data needs. Sample locations are presented in Figure 4-4. Four sampling locations are in the 216-B-3 Pond and one is in the overflow pond area. Sample site placement is biased toward topographically low areas of the pond bottoms and in the "delta" areas where the 216-B-3-1, 216-B-3-3, and the 216-B-3 Pond outlet ditches entered the main pond. Selection of sample locations was coordinated with placement of deeper borings (Section 4.2.3.3), which also address shallow soil conditions. These are areas where contaminant concentrations, based on the model of contaminant distribution, would tend to be highest. The sample in the overflow pond area will be sited using radiation surveys or, if no "hot spots" are encountered, located in the center of the overflow pond area. No test pit/auger hole sampling locations are required in the 216-B-3B or 216-B-3C Expansion Ponds because existing data were considered sufficient. One location has been selected for the 216-B-3A Expansion Pond in a topographic low (the trench excavated in the pond bottom) to confirm existing data that potential contaminants are very low or below detection.

Use of test pits versus auger hole sampling will be evaluated based on subsurface radiological conditions. Soil samples will be collected at depths (beginning at the original pond bottom) of 0.6 m (2 ft), 2 m (5 ft), 3 m (10 ft), 5 m (15 ft), and 6 m (20 ft). Samples also will be taken in areas where field screening reveals radioactivity twice background or organic vapor readings on field instruments of 5 ppm or more. To support soil chemical and soil radiological sampling data needs, all samples will be analyzed for the total list of constituents presented in Table 3-2. Furthermore, samples taken from the 216-B-3 Main Pond and 216-B-3-3 Ditch will be analyzed for the modified Appendix IX list discussed in Appendix C.

4.2.3.3 Borehole Samples. Two boreholes will be advanced in the 216-B-3 Pond to address data needs for the intermediate and deep vadose zone. Borehole locations are depicted in Figure 4-4. The intermediate borehole to 15 m (50 ft) is located in the deepest portion of the pond, near the 216-B-352 overflow structure. The deep borehole to groundwater is located in the western center of the pond between the outfalls of the 216-B-3-1 and 216-B-3-3 Ditches. These two locations, when combined with shallow test pit/auger holes, fulfill data requirements for contaminant distribution. The deep borehole is selected for the west side of the pond near the inlets. The intermediate borehole was selected for the east end to provide a comparison of soil conditions at one end of the pond to the other.

The borehole located at the west end of the pond will be advanced to groundwater [estimated to be approximately 58 to 61 m (190 to 200 ft) below land surface]; the borehole at the eastern end of the pond will be advanced to a depth of 15 m (50 ft) below the original pond bottom. Samples will be taken at all major lithologic changes in the borehole or at depths of 0 m (0 ft), 0.6 m (2 ft), 2 m (5 ft), 3 m (10 ft), 6 m (20 ft), 9 m (30 ft), 12 m (40 ft), and 15 m (50 ft), 23 m (75 ft), 30 m (100 ft), and 46 ft (150 ft) below the original pond bottom. An additional sample will also be taken to support risk assessment activities either at the surface in areas where field screening reveals radioactivity twice background or organic vapor readings on field instruments of 5 ppm, or between 2 and 2 m (5 ft) below land surface. Specific sample depths will be based on anticipated lithologies as determined by the field geologist and the project manager, and as observed during drilling. To support soil chemical and soil radiological data needs, all samples will be analyzed for the total list of constituents as presented in Table 3-2. Furthermore, samples taken from the 216-B-3 Main Pond and 216-B-3-3 Ditch will be analyzed for the modified Appendix IX list discussed in Appendix C. To support soil physical data needs, physical samples will be taken at each major lithologic change and tested for physical properties as described in Section 5.1.5.2. This information will be used to refine knowledge of vadose zone hydrogeologic properties and assist in future modeling efforts. If required for groundwater characterization efforts, the soil boring advanced to groundwater may be completed as a well. Gross gamma and RLS gamma borehole geophysical surveys will be conducted after installation of each temporary casing string to support borehole geophysical survey data needs.

4.2.4 Other Field Activities

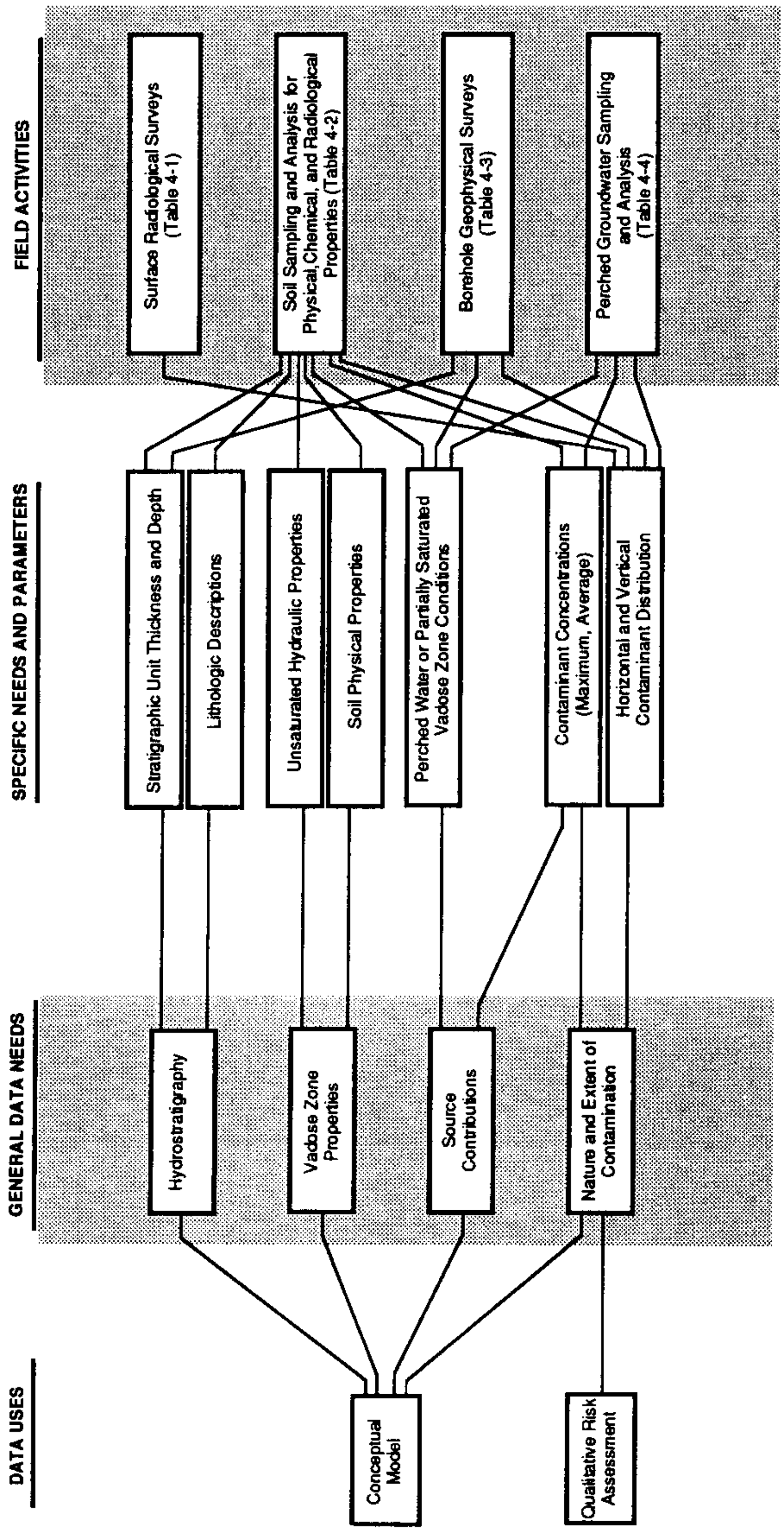
Other field activities to support data needs include air sampling, perched water sampling, and pipeline integrity monitoring.

4.2.4.1 Air Sampling. Air samples will be taken during characterization activities for health and safety monitoring and to confirm that contaminants are not being spread by wind. Air monitoring is discussed in more detail in Sections 5.1.1.6, 5.1.3.3.2, and 5.1.4.10.

4.2.4.2 Perched Water Sampling. Samples will be taken of perched water encountered during soil borings. Samples will be taken from each zone of perched water identified and analyzed for target analytes as presented in Table 3-2, plus additional analyses for fluoride, carbon-14, and tritium. As agreed in the DQO process, the additional analytes are potential contaminants of concern but are not analyzed for soil samples due to their high mobility and low likelihood of detection in soil. Analyses for anions and metals will be conducted both for unfiltered samples and samples passed through a 0.45-micron filter in the field during collection. If perched water is encountered during borehole drilling in sufficient quantity for sampling and continued monitoring, a well will be installed in the perched water zone to monitor potential contamination in this zone. Up to one perched water well will be installed per waste management unit, as necessary.

4.2.4.3 Pipeline Integrity Monitoring. The process effluent pipelines within the 200-BP-11 Operable Unit are depicted in Figure 3-1 and Plate 1. The PUREX Cooling Water Line and the 216-B-3-2 Pipeline are the only pipelines of interest to the operable unit investigation because all other pipelines are active or associated with other facilities. A surface radiation survey will be performed over these two pipelines consisting of approximately 700 m (2,300 ft). Two sections of pipe are to be further assessed: the capped PUREX Cooling Water Line leading to the Gable Mountain Pond and the southern segment of the 216-B-3-2 Pipeline. An internal camera and radiation survey will be performed on these portions of pipe if technically and economically feasible. The emphasis of these surveys will be to assess pipeline integrity, identify potential leak points, and attempt to correlate the leak points to potential surface contamination. An assessment for potential soil sampling will be made after these surveys are complete. If areas of probable leaks are detected, an assessment of potential contamination will be performed, and additional soil samples may be taken and analyzed for constituents listed in Table 3-2.

Figure 4-1. Relationships Between Data Uses, Data Needs, and Field Activities for the LFI.



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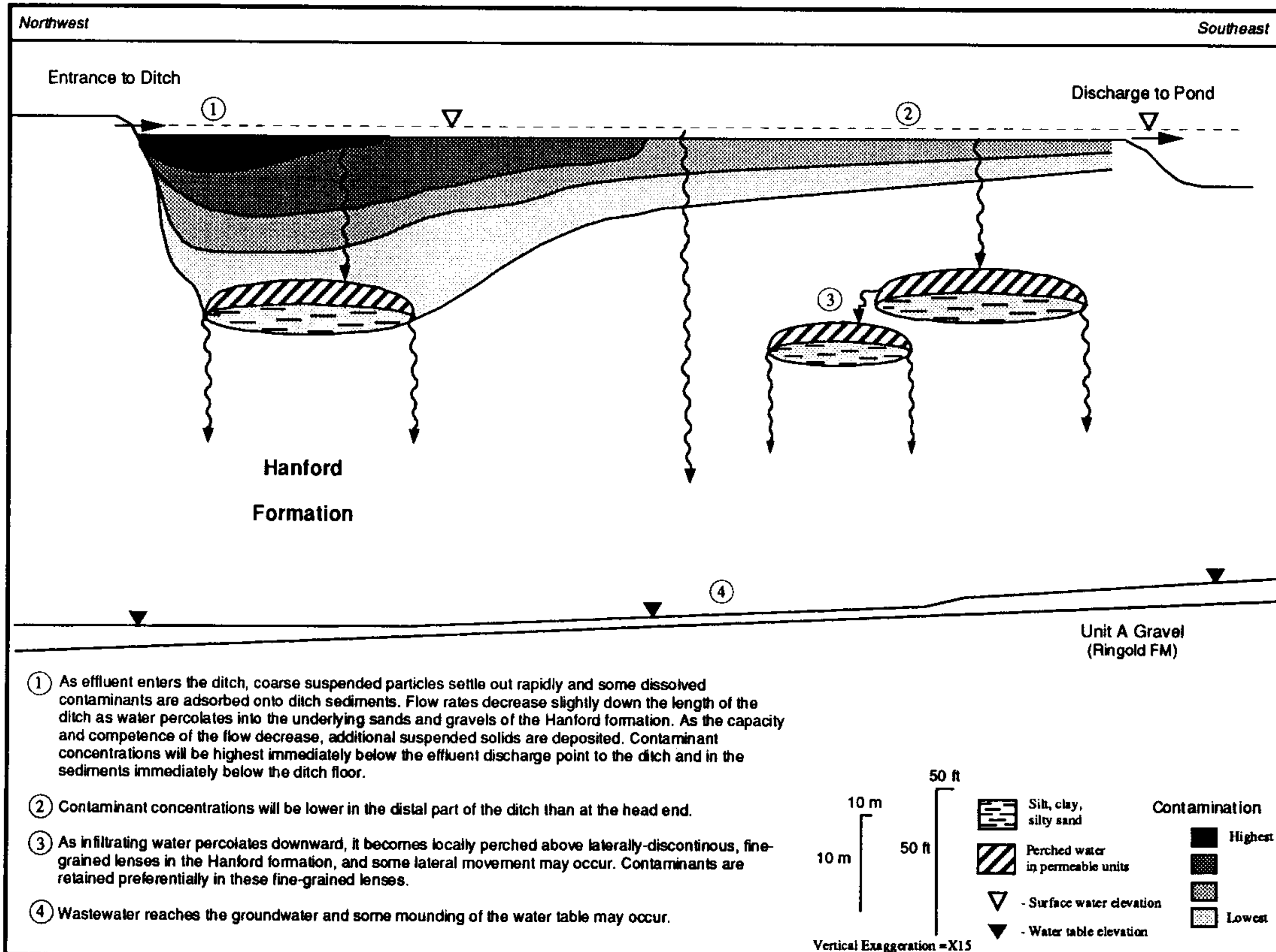

Figure 4-2. Schematic Conceptual Model of Contaminant Fate and Transport in Ditches.

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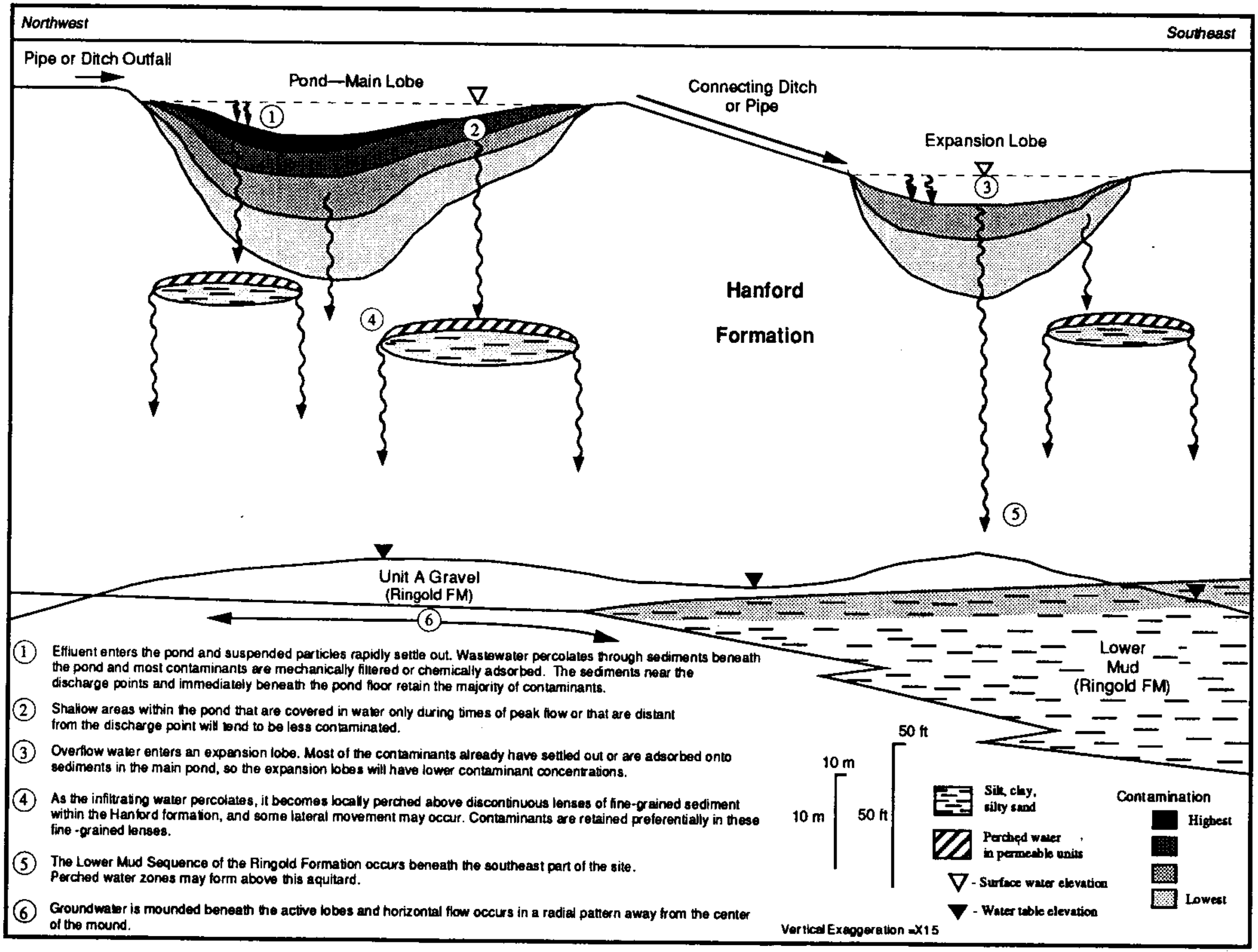

Figure 4-3. Schematic Conceptual Model of Contaminant Fate and Transport in Ponds.

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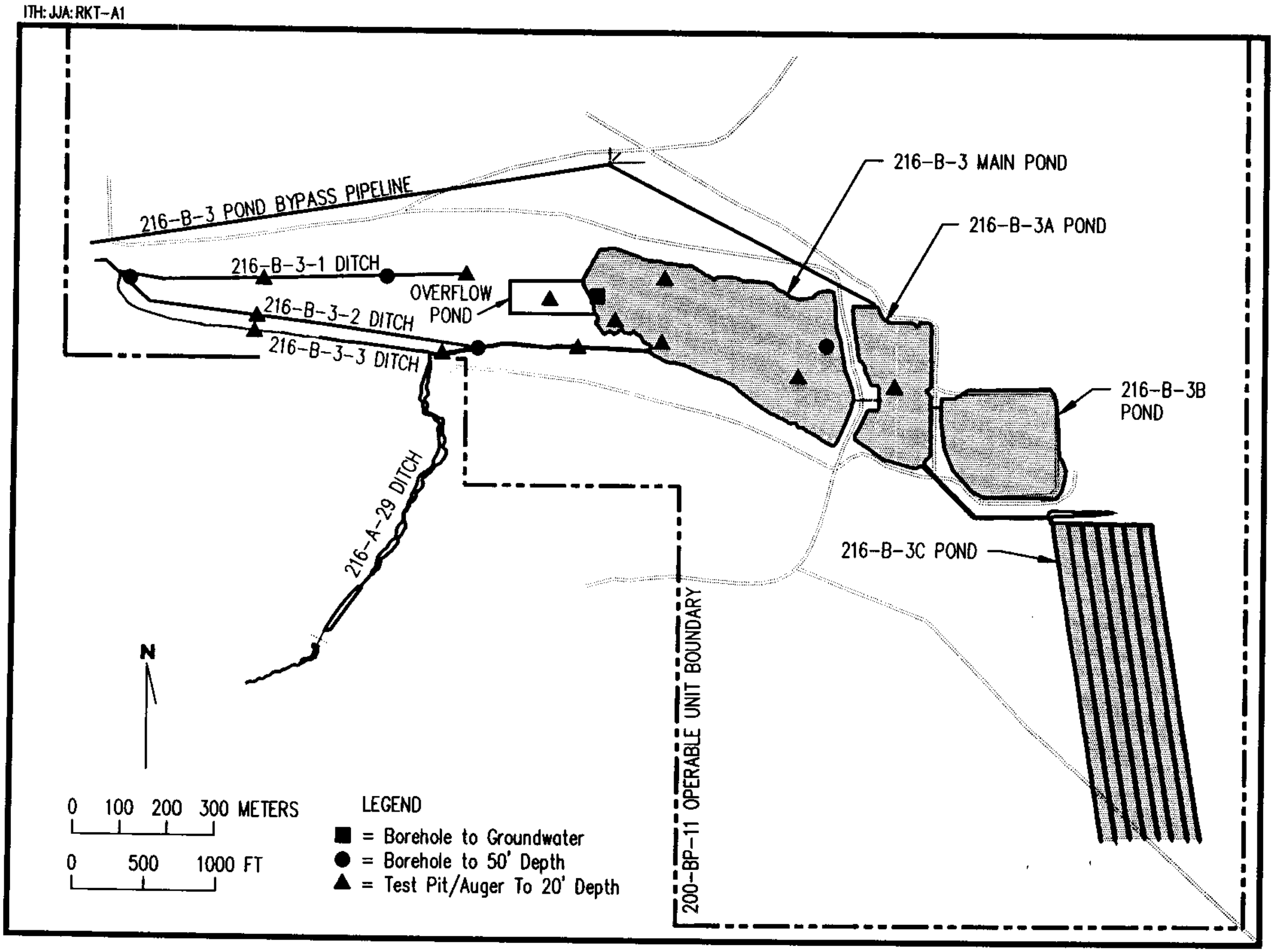

Figure 4-4. Locations of Shallow, Intermediate, and Deep Vadose Zone Borings.

Table 4-1. Data Quality Objectives for Surface Radiological Surveys.

Activity	Screen potential sampling sites for background and elevated levels of radioactivity. Screening is conducted both as normal operating procedures for the operable unit and as health and safety monitoring during intrusive field activities.
Objectives	Locate "hot spots" where radiation levels are twice background readings.
Prioritized Data Use(s)	Refine sampling locations to target potential zones of maximum contamination.
Appropriate Analytical Level or Implementation Guidelines	Surface radiation surveys will be carried out according to EII 2.3 (WHC 1988b) and descriptions of work.
Parameters to be Obtained	Location, date, time, calibration data, and radiation level reading.
Required Detection or Measurement Limits	Surveys will follow standard operating procedures as outlined in EII 2.3 (WHC 1988b) and descriptions of work.
Critical Samples or Values	N/A
Constraints	• Background readings must be taken in an uncontaminated area. • Instruments must be properly calibrated.

Table 4-2. Data Quality Objectives for Soil Sampling and Analysis for Physical, Chemical, and Radiological Sampling.

Activity	Collect soil samples during test pit/auger and borehole drilling and analyze samples for physical, chemical, and radiological properties.
Objectives	Soil sampling will address data needs of vertical and horizontal distribution of contaminants through chemical and radiological analysis and data needs of geologic/hydrologic characterization through physical analysis.
Prioritized Data Use(s)	The priority data uses are to support characterization of geology and hydrostratigraphy, and contaminant characteristics and transport for refining the conceptual model, as well as support the conduct of the qualitative risk assessment.
Appropriate Analytical Level or Implementation Guidelines	Samples will be collected according to procedures outlined in EII 5.2 (WHC 1988b) and descriptions of work.
Parameters to be Obtained	Bulk density, particle size distribution, moisture content, pH, unsaturated hydraulic conductivity, metals, volatile organics, semivolatile organics, and radionuclides.
Required Detection or Measurement Limits	Analytical detection limits and data quality objective requirements are identified in the Quality Assurance Project Plan (Appendix A).
Critical Samples or Values	One sample from each lithologic unit encountered at a given sample location.
Constraints	Single samples can be assessed statistically only with comparison to data from previous investigations or other boreholes, or where field duplicates are collected.

Table 4-3. Data Quality Objectives for Borehole Geophysical Surveys.

Activity	Perform radionuclide logging system spectral gamma and gross gamma logging on all boreholes and on selected existing wells.
Objectives	Geophysical logging of boreholes will help define hydrostratigraphy, source contributions, and nature and extent of contamination.
Prioritized Data Use(s)	The priority data uses are to support characterization of contaminant distribution and hydrostratigraphy in support of refining the conceptual model.
Appropriate Analytical Level or Implementation Guidelines	Boreholes will be logged according to EII 11.1 (WHC 1988b) and descriptions of work.
Parameters to be Obtained	Depth of logging, logging speed, base calibration date, date and time of logging, gross gamma activity, and gamma spectrum.
Required Detection or Measurement Limits	Surveys will follow standard operating procedures, as identified in EII 11.1 (WHC 1988b).
Critical Samples or Values	All boreholes drilled to 50 ft or more should be logged with radionuclide logging system spectral gamma and gross gamma. Existing wells in the operable unit that lack these data also should be surveyed.
Constraints	Existing well borehole construction may affect results. Improper sealing of old wells may yield misleading data where flow of contaminated water along well casings may have deposited radionuclides.

Table 4-4. Data Quality Objectives for Perched Water Sampling.

Activity	Sample perched water encountered in boreholes during ongoing sampling activities for physical, chemical, and radiological properties. Install wells in perched water zones after sampling.
Objectives	Perched water sampling and analysis will address data needs for the vertical and horizontal extent of contamination, and refine the conceptual and hydrostratigraphic model.
Prioritized Data Use(s)	The priority data uses are to support characterization of the vertical and horizontal extent of contamination and refine the conceptual model, as well as support the conduct of the qualitative risk assessment.
Appropriate Analytical Level or Implementation Guidelines	Perched water sampling will be carried out under the guidance of EII 5.8 (WHC 1988b) and descriptions of work. Perched water well installation will be carried out according to procedures outlined in EII 6.9, WAC 173-160, and descriptions of work.
Parameters to be Obtained	Volatile organics, semivolatile organics, metals, and radionuclides.
Required Detection or Measurement Limits	Analytical detection limits and data quality objective requirements are identified in the Quality Assurance Project Plan (Appendix A).
Critical Samples or Values	One sample from each perched water zone encountered, including one unfiltered and one field filtered for metals.
Constraints	• Improper well seals may provide a flow conduit along well annulus. • Inadequate supply of water in perched zone may limit the kinds of analyses performed and the representativeness of the sample.

5.0 RCRA FACILITY INVESTIGATION AND CORRECTIVE MEASURES STUDY

This chapter describes the field investigation activities and CMS that will support the RFI for the past-practice and TSD units within the 200-BP-11 Operable Unit. The activities are designed to provide information to meet the DQOs identified among the DOE, Ecology, and EPA as discussed in Section 4.2.1 and listed in Appendix C. After the field investigation and CMS are complete, corrective measures will be identified for the operable unit.

Section 5.1 discusses the field investigation process and describes the project framework of tasks recommended to be implemented during the field investigation. These tasks are designed to provide information needed to meet the DQOs identified in Section 4.1. The final determination of field activities and detailed information needed to carry out these tasks will be presented in descriptions of work for the operable unit (see Section 5.1.2.4, Subtask 1d). The results of the field investigation and associated activities will be provided in Volume 2 of this work/closure plan.

Section 5.2 describes the process that will lead to future corrective measures. It includes discussion regarding the CMS and treatability studies that will ultimately lead to a CMP and Hanford Facility Site-Wide Permit modification. A detailed analysis of a limited number of remedial alternatives for corrective measures will be conducted as part of the CMS. The CMS will utilize the analysis of remedial alternatives completed as part of the B Plant Aggregate Area Management Study (AAMS) Report (Sections 9.4 and 9.5, DOE-RL 1993c) and current alternatives that have become available since completion of the AAMS report.

5.1 FIELD INVESTIGATION PROCESS

The necessary activities and program framework required to accomplish the field investigation goals are presented in Section 5.1.1. The activities are designed to provide information necessary to meet the DQOs identified among the DOE, Ecology, and EPA as discussed in Section 4.2.1 and listed in Appendix C.

Section 5.1.1 describes the work breakdown structure by which the field investigation activities will be implemented. The tasks designated by the work breakdown structure will be used to manage the budget and schedule the field investigation activities. Section 5.1.2, "Project Management (Task 1)," summarizes the management activities associated with implementing the data gathering and interpretation tasks of this work/closure plan. Section 5.1.3, "Field Investigation Activities (Tasks 2 to 6)," describes the proposed field data-gathering activities. These field activities identify specific activities recommended to be conducted for the field investigation. Final determination of the field investigation activities will be made through one or more descriptions of work for the operable unit. The field investigation procedures and protocols are provided in Section 5.1.4 and the laboratory analysis in Section 5.1.5. Sections 5.1.6 through 5.1.9 describe the data interpretation tasks leading to the production of the field investigation report. These tasks include data evaluation (Section 5.1.6); QRA (Section 5.1.7); identification and/or verification of potential action-, contaminant-, and location-specific CMRs (Section 5.1.8); and production of the field investigation report (Section 5.1.9).

5.1.1 Work Breakdown Structure

This section summarizes the tasks to be implemented during the field investigation studies at the 200-BP-11 Operable Unit. Tasks are the primary controlling framework within which the field investigation is conducted. Each task describes a primary need or goal of the field investigation. The tasks are controlled and implemented by a series of associated subtasks and activities. Ten distinct tasks are described in this section: project management (Task 1); source characterization (Task 2); geologic investigation (Task 3); surface water sediment investigation (Task 4); vadose zone investigation (Task 5); air investigation (Task 6); data evaluation (Task 7); QRA (Task 8); identification and/or verification of action-, contaminant-, and location-specific CMRs (Task 9); and completion of the field investigation report (Task 10). Information is provided on each task to help estimate project schedules and costs.

Tasks 2 through 6 control data collection and field activities. Each of these field-related tasks is broken down into four subtasks: data compilation and review, field investigation, laboratory analysis, and data evaluation.

Data compilation and review for each of the field-related tasks was largely completed during the production of the B Plant Source AAMS Report (DOE-RL 1993c). The AAMS report presents a compilation of the historical, physical, chemical, and radiological data for the 200-BP-11 Operable unit. Additionally, Appendices C, D, and E of the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b) provides the sampling results from the surface and vadose zone investigation at the Expansion Ponds. Chapters 2.0 and 3.0 of this work/closure plan summarize the findings of these two documents. Data collected during field investigation activities will be integrated with existing data and evaluated. Data collected during nonintrusive activities, such as surface radiation surveys and surface geophysics surveys (ground-penetrating radar), will be evaluated immediately to help optimize locations for surface samples, boreholes, test pits, and auger holes. The overall data evaluation strategy is outlined in Section 5.1.6.

The relationship between the field-related tasks and field activities is summarized in Table 5-1. Many of the field activities are associated with more than one task. For example, borehole field activities will yield data for the source characterization, geologic investigation, and vadose zone investigation tasks.

The following sections briefly outline the nature of each task and subtask, and the activities with which they are associated.

5.1.1.1 Project Management (Task 1). The objectives of project management during the implementation of the field investigation work/closure plan are to direct and document project activities, to ensure that data and evaluations generated meet the goals and objectives of this work/closure plan, and to administer the field investigation and CMS within budget and schedule. The initial project management activities will be to assign individuals to roles established in the project management plan of the B Plant AAMS Report (Appendix C). The project management task is detailed in Section 5.1.2.

5.1.1.2 Source Characterization (Task 2). The purpose of the source characterization is to (1) determine the exact locations and boundaries of the waste management units and unplanned releases; (2) conduct document reviews, surveys, and sampling of source material to verify the presence and content of dangerous, radioactive, or mixed waste; and (3) collect surface and near-surface chemical and radiological data for use in a QRA.

The subtasks and field activities that are associated with the source characterization at each waste management unit are summarized in Table 5-2. The majority of source characterization data will be collected during radiation surveys, and borehole, test pit, and auger hole sampling activities. The source characterization activities are included with the field investigation activities described in Section 5.1.3.

5.1.1.3 Geologic Investigation (Task 3). The primary purpose of the geologic investigation is to characterize the stratigraphy of the vadose zone and to collect geologic data that can be used to estimate conditions that influence the occurrence, distribution, and contaminant migration through the vadose zone. The subtasks and field activities associated with the geologic investigation at each waste management unit are summarized in Table 5-3. The geologic investigation activities are included with the field investigation activities discussed in Section 5.1.3.

The majority of geologic data will be collected from the boreholes within the operable unit. This activity will produce information on the lateral extent, vertical extent, and surface geometry of aquitards in the vadose zone. These aquitards are significant because they may retard the downward movement of water and form zones of perched water that allow the lateral movement of contaminants. Physical samples collected during the boring activities will be used to characterize the hydraulic properties of various vadose zone media.

5.1.1.4 Surface Water Sediment Investigation (Task 4). The primary goal of this task is to evaluate the impact of facility operations on surface water sediments in the 200-BP-11 Operable Unit. Surface water sediments have been previously sampled in the 216-B-3 Main Pond; 216-B-3-3 Ditch; and 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds during Phase 1 and 2 sampling activities as discussed in Chapter 3.0. Also, during the spring of 1994, all water was routed to the 216-B-3C Expansion Pond, and the surface water sediments in the 216-B-3 Main Pond and 216-B-3-3 Ditch have since been covered as discussed in Section 2.6, "Interim Stabilization Activities at the 216-B-3 Main Pond and the 216-B-3-3 Ditch." Therefore, additional sediment samples will be obtained indirectly during borehole, test pit, and auger hole sampling activities.

5.1.1.5 Vadose Zone Investigation (Task 5). The primary objective of this task is to define the nature and vertical extent of contamination in the vadose zone. This includes characterizing contamination in vadose zone soils and in perched water. The subtasks and field activities associated with the vadose zone investigation are summarized in Table 5-4. The vadose zone data will be collected during borehole, test pit, and auger hole sampling activities.

The vadose zone beneath the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds was previously characterized during the Phase 3 sampling activity discussed in Chapter 3.0. Additional vadose zone characterization activities in these units will be limited with efforts concentrated on the 216-B-3A Expansion Pond. The 216-B-3A Expansion Pond will serve as the analog unit for the other two ponds.

Vadose zone activities are further discussed with the field investigation activities in Section 5.1.3.2.

5.1.1.6 Air Investigation (Task 6). The scope of this task is to establish background concentrations of airborne contaminants, evaluate the potential impact of contaminated air inhalation to workers during intrusive field activities, and to monitor the impacts of field activities on area-wide air quality. The subtasks and field activities associated with the air investigation are summarized in Table 5-5. The background and area-wide air data will be collected from existing air sampling networks (see Plate 1) established by Westinghouse Hanford Company. The potential impacts of contaminated air inhalation to workers during intrusive field activities will be evaluated utilizing portable air monitors. The air investigation activities are further discussed in Section 5.1.3.3 (non-specific field investigation activities) and Section 5.1.4 (protocols and procedures). Note that additional air monitoring activities for personal safety and health may be required in future safety documentation (e.g., Safety Analysis Documents and Hazardous Waste Operations Plans).

5.1.1.7 Data Evaluation (Task 7). Data generated during the field investigation will be evaluated and integrated with existing data in an ongoing manner. Data from some field activities will be used to define later activities. The data evaluation task is described in detail in Section 5.1.6.

5.1.1.8 Qualitative Risk Assessment (Task 8). Qualitative risk assessments will be performed on waste management units that are eligible for corrective measures. These assessments provide a semiquantitative assessment of risk and will be focused on the principal risk drivers in the operable unit. The results of these assessments will be used to help determine the need for a corrective measure, to select the corrective measure, and to determine risk-based cleanup levels for the corrective measure. The QRA is discussed in detail in Section 5.1.7.

5.1.1.9 Identification of Potential Action-, Contaminant-, and Location-Specific Corrective Measure Requirements (Task 9). The identification of potential operable unit-specific CMRs will be an ongoing effort during the field investigation and corrective measure processes and is further described in Section 5.1.8.

5.1.1.10 Field Investigation Report (Task 10). A report will be prepared that presents the results of the field investigation and QRA at each waste management unit. The field investigation report is described in more detail in Section 5.1.9.

5.1.1.11 Other Tasks (Task 11). This task has been reserved in the event that additional tasks are identified during the course of the project.

5.1.2 Project Management (Task 1)

This section presents a summary overview of the project management subtask activities that will occur throughout the field investigation process and includes the following:

- Subtask 1a, Project Management (Section 5.1.2.1)
- Subtask 1b, Meetings (Section 5.1.2.2)
- Subtask 1c, Cost and Schedule Control (Section 5.1.2.3)
- Subtask 1d, Data Management (Section 5.1.2.4)
- Subtask 1e, Progress Reports (Section 5.1.2.5)
- Subtask 1f, Quality Assurance (Section 5.1.2.6)
- Subtask 1g, Health and Safety (Section 5.1.2.7)
- Subtask 1h, Community Relations (Section 5.1.2.8).

5.1.2.1 Project Management (Subtask 1a). Project management includes the day-to-day supervision of, and communication with, project staff and subcontractors. Throughout the project, daily communication between office and field personnel will be attempted, along with periodic communication with subcontractors. This constant and continual exchange of information will be necessary to assess progress, to identify potential problems quickly enough to make necessary corrections, and to keep the project within the budget and focused on the objectives and schedule. Details of the project management plan are provided in Appendix C of the B Plant AAMS Report (DOE-RL 1993c).

5.1.2.2 Meetings (Subtask 1b). Meetings will be held, as necessary, with members of the project staff, subcontractors, regulatory agencies, and other appropriate groups to communicate information, assess project status, and resolve problems. A kickoff meeting will be held with designated project personnel, and project staff meetings will be held weekly. The 200-BP-11 Operable Unit project coordinators will meet on a weekly basis to share information and to discuss progress and problems. The frequency of other meetings will be determined based on need and on schedules in the Tri-Party Agreement (Ecology et al. 1994).

5.1.2.3 Cost and Schedule Control (Subtask 1c). Project costs, including labor, other direct costs, and subcontractor expenses, will be tracked monthly using an earned-value approach. The budget for tracking activities will be computerized and will provide the basis for invoice preparation and review and for preparation of progress reports. Scheduled milestones will be tracked monthly for each task of each project phase. This will be done in conjunction with cost tracking.

5.1.2.4 Data Management (Subtask 1d). The work activity file for the 200-BP-11 Operable Unit will be kept organized, secured, and accessible to project personnel. The project file will be maintained to comply with the Information Management Overview, which is included in the B Plant AAMS Report, Appendix D. All field reports, field logs, health and safety documents, QA/quality control (QC) documents, laboratory data, memoranda, correspondence, and reports will be logged into the file upon receipt or transmittal. This task is also the mechanism for ensuring that data management procedures are carried out as documented in the B Plant AAMS Report Information Management Overview.

5.1.2.5 Progress Reports (Subtask 1e). Progress reports prepared at quarterly intervals are believed to be sufficient for purposes of the field investigation and CMS. The reports will be prepared, distributed to project personnel (project and unit managers, coordinators, contractors, subcontractors, etc.), and entered into the 200-BP-11 Operable Unit project file. The reports will summarize the work completed, present data generated, and provide evaluations of the data as they become available. Progress, anticipated problems, recommended solutions, upcoming activities, key personnel changes, status of deliverables, and budget and schedule information will be included in the reports.

5.1.2.6 Quality Assurance (Subtask 1f). All work on the Hanford Site is subject to the requirements of DOE Order 5700.6C, *Quality Assurance* (DOE 1991) and other QA guidance documents as applicable, e.g., the Hanford Analytical Services Quality Assurance Plan (HASQAP) (DOE-RL 1994). Such documents establish broadly applicable QA program requirements for all types of project activities. To ensure that the objectives of this field investigation are met in a manner consistent with the DOE order, all work conducted by BHI will be performed in compliance with existing QA manuals and the Environmental Engineering and Technology Function QAPjP that specifically describes the application of manual requirements to environmental investigations. The

200-BP-11 Operable Unit QAPjP (Appendix A) details the QA/QC protocols to be followed during the 200-BP-11 Operable Unit RFI/CMS process. The QAPjP defines the specific means that will be used to ensure that the sampling and analytical data are defensible and will effectively support the purposes of the investigation.

5.1.2.7 Health and Safety (Subtask 1g). The Health and Safety Plan (B Plant AAMS Report, Appendix B) will be used to implement standard health and safety procedures for BHI employees and contractors engaged in field investigation and CMS activities in the 200-BP-11 Operable Unit.

Activities associated with field sampling and sample transport may involve both external and internal exposure to ionizing radiation from adjacent tanks, piping, and contaminated soils. Sample collection activities may also involve exposure to hazardous chemicals. Review by BHI Occupational Health and Safety and issuance of any Radiation Work Permits and Hazardous Waste Operations Plans [EII 2.1, "Preparation of Site-Specific Health and Safety Plans" (WHC 1988a)] will be performed prior to the start of any sampling activity. All personnel entering the job site will fulfill the minimum requirements for entry as discussed in EII 1.1, "Hazardous Waste Site Entry Requirements" (WHC 1988b).

An as low as reasonably achievable (ALARA) plan that addresses the potential radiation exposure of task personnel during field tasks will be completed prior to the commencement of field operations. Guidance on such assessments is found in WHC-CM-4-11 (WHC 1988a) as referenced in EII 2.3, "Administration of Radiation Surveys to Support Environmental Characterization Work on the Hanford Site" (WHC 1988b). A radiation dose assessment evaluation will be performed for the anticipated soil samples and on its completion will be used in conjunction with estimates of sample size and duration of exposure to prepare an ALARA plan.

5.1.2.8 Community Relations (Subtask 1h). Community relations activities will be conducted in accordance with the Community Relations Plan for the Hanford Site (Ecology et al. 1989). All community relations activities associated with the 200-BP-11 Operable Unit will be conducted under this overall Hanford Site Community Relations Plan.

5.1.3 Field Investigation Activities (Tasks 2 to 6)

The field investigation activities are designed to accomplish the following tasks: source characterization (Task 2), geologic investigation (Task 3), surface water sediment investigation (Task 4), vadose zone investigation (Task 5), and air investigation (Task 6). These tasks are described briefly in Section 5.1.1. This section recommends specific activities to be conducted for the field investigation, although final determination of field activities will be made through issuance of descriptions of work.

Table 5-6 summarizes the field activities that are planned at each waste management unit and unplanned release site. Several activities that are not associated with individual waste management units are listed in the table under their own headings. In addition, the table has been divided between primary field activities and supporting field activities. Supporting field activities must generally be conducted along with each of the primary field activities. The subsections of this work/closure plan describing each field activity and waste management unit are also listed in the table.

Section 5.1.3.1 discusses the overall approach to the field investigation. Section 5.1.3.2 discusses the locations and frequencies of each activity and is subdivided into groups of TSD units, past-practice units, and unplanned release units. The protocols and procedures for each type of field activity are described in Section 5.1.4. Section 5.1.5 describes the laboratory analyses that each sample will undergo.

5.1.3.1 General Approach. The general sequence of activities for the each waste management unit is as follows:

(1) Surface radiation surveys (Section 5.1.4.1)
(2) Ground-penetrating radar surveys (Section 5.1.4.2)
(3) Electromagnetic surveys
(4) Subsurface spectral geophysics on appropriate existing wells (Section 5.1.4.5)
(5) Surface soil sampling
(6) Test pits and auger holes
(7) Boreholes with spectral geophysics as casing is telescoped
(8) Perched water sampling.

Activities one through four aid in the refinement of sampling points for activities five through seven. Surface radiation surveys are run for health and safety reasons, to identify potential surface soil sampling locations, and to refine borehole, test pit, and auger hole locations. If no surface contamination is detected during the surface radiation survey, then no surface soil sampling will occur at that waste management unit. Subsurface investigations (boreholes, test pits, and auger hole) will proceed whether or not surface contamination is detected. Surface geophysics surveys (ground-penetrating radar and electromagnetic) will be used to better identify the boundaries of the 216-B-3-1 and 216-B-3-2 Ditches and existing pipelines. Subsurface spectral gamma logging may be used to identify radioactivity within the vadose zone thus identifying potential sampling points in nearby proposed boreholes.

Figure 4-4 depicts the sampling design for the operable unit. This design has been previously agreed on by the DOE-RL and the regulators as a result of DQO meetings (see Section 4.1) held for the operable unit. It was also agreed that additional sampling efforts would be defined after the evaluation of data obtained from this sampling scheme. The intent of the sampling design is to locate the areas of highest contamination in the operable unit and to provide sufficient data to make final corrective measure decisions. The remainder of this section discusses the sampling approach for the proposed sampling scheme shown in Figure 4-4.

5.1.3.1.1 Field Screening and Action Levels. All samples and cuttings will be field screened for evidence of volatile organics and radionuclides. Volatiles will be screened by the field geologist or other qualified personnel using an organic vapor monitor. Radionuclides will be screened by alpha- and gamma-counting instruments. The protocols and procedures for field screening is further discussed in Section 5.1.4.3.2.

The action level for radionuclide screening is twice background. Readings of less than twice the average background are within the normal background variability for the site and therefore are not indicative of the presence of anthropogenic radionuclides. The action level for volatile organic screening is 5 ppm. Areas above the prescribed action levels will be referred to as "hot spots."

Prior to initiating drilling, a local area background reading will be determined at a background site to be determined in the field (e.g., the 216-E-28 Contingency Pond).

5.1.3.1.2 Risk Assessment Sampling. The purpose of this section is to ensure that samples are obtained from borehole, test pit, and auger hole sites to support risk assessments. To support a risk assessment evaluation of the external exposure pathway for humans and exposure to burrowing animals, a sample should be taken in the upper 2 m (6 ft) of soil. Additional sampling for risk assessment is desired at a depth of 5 to 6 m (15 to 20 ft) to evaluate the potential exposure to humans or wildlife through plant uptake. This additional sampling will be fulfilled as part of the vadose zone sampling investigation discussed in the next section.

If surface radioactivity is less than twice background, and continues to be less than twice background at depth, a sample is needed only to support a risk assessment, i.e., from between 0.6 to 2 m (2 to 6 ft). After a risk assessment sample has been taken, another sample does not need to be obtained until the sediments (i.e., the pond/ditch bottoms) are encountered. However, if radioactivity (or other field screening) warrants, additional samples may be obtained at the discretion of the field geologist in consultation with the operable unit task lead. Sampling from the sediments to depth will be taken in accordance with Section 5.1.3.1.3.

If surface radioactivity is above twice background, a surface sample may be taken. However, if activity continues to increase below the surface, a sample of greater radioactivity may be taken instead of a surface sample. In either case, a sample must be taken from 0.6 to 2 m (2 to 6 ft) to support a risk assessment. After a risk assessment sample has been taken, another sample does not need to be obtained until the sediments are reached. However, if radioactivity (or other field screening) warrants, additional samples may be obtained at the discretion of the field geologist. Sampling from the sediments to depth will be taken in accordance with Section 5.1.3.1.3.

5.1.3.1.3 Vadose Zone Sampling. This section describes the soil sampling points for vadose zone sampling in boreholes, test pits, and auger holes. Vadose zone samples will be taken at predetermined depths, lithological interfaces, and/or hot spots (Section 5.1.3.1.1, areas above twice background for radioactivity and/or 5 ppm for organic vapors).

Pre-established default sampling depths for chemical and physical samples are described below and will be used in conjunction with lithologic changes and hot spot sampling. These depths are approximate, and excavated material will be screened in the field so that the most contaminated soils are sampled. The sampling depths listed below are based on a zero datum at the sediment (pond/ditch bottoms) horizon.

- Groundwater borehole -- 0, 0.6, 2, 3, 6, 9, 12, 15, 23, 30, and 46 m (0, 2, 5, 10, 20, 30, 40, 50, 75, 100, and 150 ft), with an additional sample, if possible, above the water table [about 61 m (200 ft)]

- Shallow boreholes [15 m (50 ft)] -- 0, 0.6, 2, 3, 6, 9, 12, and 15 m (0, 2, 5, 10, 20, 30, 40, and 50 ft)

- Auger holes and test pits -- 0, 0.6, 2, 3, 6, and 9 m (0, 2, 5, 10, 15, and 20 ft).

Chemical and physical samples will be taken at major lithologic changes. Estimates of these lithologic changes will be made prior to drilling using current stratigraphy maps. However, the field geologist will make the final determination of the actual sampling location. Additionally, the field geologist will make the decision as to when to sample a hot spot. Typically, the first indication of a hot spot will trigger sampling.

5.1.3.2 Sampling Locations and Frequencies. As discussed in Section 5.1.3.1, surface radiation surveys, surface geophysics surveys, and spectral gamma logging will be used to refine sampling locations and frequencies of surface samples, boreholes, test pits, and auger holes. The general approach to the frequency of sampling at depth was discussed in the previous section.

The approximate sampling locations for boreholes, test pits, and auger holes are shown in Figure 4-4 and described in the following sections.

5.1.3.2.1 216-B-3 Main Pond, Overflow Pond, and 216-B-3-3 Ditch. A surface radiation survey was performed at the 216-B-3 Main Pond and 216-B-3-3 Ditch during interim stabilization (backfilling) activities in 1994 (Section 2.6). The results of the survey will be used to optimize sampling locations at the areas of highest contamination. Additionally, nearby existing monitoring wells, 699-44-43B, 699-44-42, 699-43-43, 699-43-45, and 699-43-42J (see Plate 1), will undergo RLS logging, prior to intrusive activities, to identify whether any particular sediment horizon may be more likely to exhibit elevated activities.

Surface sampling activities are not expected at the 216-B-3 Main Pond or 216-B-3-3 Ditch because of the recent interim stabilization activities. Surface samples are more likely to be taken from the overflow pond. Surface samples may be taken if warranted by radiation surveys (Section 5.1.3.1.2).

Two boreholes and four auger holes are planned at the 216-B-3 Main Pond. One 15-m (50-ft) borehole will be placed at the eastern midline (deepest section) of the pond and one borehole to groundwater at the western midline of the pond. The auger holes will be located as follows: one in the southwest corner of the pond; one in the delta area of the 216-B-3-3 Ditch (south side of the pond); another on the north side of the pond directly north of the 216-B-3-3 Ditch delta area; and the last one in the southeast region of the pond.

Only one intrusive characterization activity is planned for the overflow pond. One test pit will be established in the location of highest radioactivity identified by a surface radiation survey or, if no surface radiation is detected, the test pit will be placed in the center of the Overflow Pond.

One borehole and three auger holes are planned at the 216-B-3-3 Ditch. Test pits may be used instead of the auger holes if judged acceptable by health physics personnel. A 15-m (50-ft) borehole will be placed at the confluence of the 216-B-3-2 and 216-B-3-3 Ditches. Another borehole will be located at the headwall (west end) area of the ditch but is identified with the 216-B-3-1 Ditch. The auger holes will be placed as follows: one midway between the 216-A-29 Ditch (200-PO-5 Operable Unit) and the headwall (west end); one just east of the A-29 Ditch; and one midway between the borehole and main pond.

5.1.3.2.2 216-B-3-1 and 216-B-3-2 Ditches. A surface radiation survey and geophysics survey will be performed at the 216-B-3-1 and 216-B-3-2 Ditches. The results of the survey will be used to optimize sampling locations at the areas of highest contamination. Additionally, nearby existing monitoring well, 699-43-45 (see Plate 1), will undergo RLS logging, prior to intrusive activities, to identify whether any particular sediment horizon may be more likely to exhibit elevated activities.

Surface sampling activities are not specifically planned for these ditches because they have been interim stabilized. However, surface samples may be taken if warranted by radiation surveys. Also, the general sampling scheme (Section 5.1.3.1.2) ensures that the near surface [0.6 to 2 m (2 to 6 ft)] is sampled during subsurface characterization activities.

Two boreholes and three test pits are planned at the 216-B-3-1 and 216-B-3-2 Ditches. Auger holes will be used instead of the test pits if high radiation or other health- and safety-related conditions warrant. One 15-m (50-ft) borehole will be located at the east end (headwall) of the ditches, and another 15-m (50-ft) borehole will be established in the 216-B-3-1 Ditch midway between the headwall and 216-B-3 Main Pond. Two test pits will be established in the 216-B-3-1 Ditch: one midway between the two boreholes and one at the western end of the ditch approximately midway between the borehole and 216-B-Main Pond. The third test pit will be located in the 216-B-3-2 Ditch in line with the westernmost test pits of the 216-B-3-1 and 216-B-3-3 Ditches.

5.1.3.2.3 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds. The 216-B-3A Expansion Pond is considered the analog unit for the 216-B-3B and 216-B-3C Expansion Ponds because all liquid received by the 216-B-3B and 216-B-3C Ponds passed through the 216-B-3A Pond. Additionally, these three ponds were characterized during Phase 1, 2, and 3 activities (Section 3.1), and are currently being assessed for clean closure in the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b). However, Phase 1, 2, and 3 activities did not fully characterize the ponds for the radionuclides of concern to the operable unit, and therefore will be further assessed for radionuclides.

A surface radiation survey will be performed at all three ponds. Some radiation surveys will be performed at the 216-B-3A Pond as part of the interim stabilization activities (see Section 2.6). The results of these surveys will be evaluated to determine if additional surveys are needed at the 3A Pond. Radiation surveys at the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds will be included with the nonintrusive activities. The results of the surveys will be used, if needed, to locate potential sampling locations.

Surface sampling activities are not specifically planned for the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds because of surface characterization previously performed during Phases 1 and 2 (Section 3.1). However, surface samples may be taken if warranted by radiation surveys. Nearby existing monitoring wells, 699-43-45 and 699-44-43 (see Plate 1), will undergo RLS gamma spectrometer surveys to identify potential areas of elevated radiation for vadose zone characterization.

A borehole to groundwater was drilled in each of the three ponds and the soils characterized as part of the Phase 3 activities (Section 3.1). This characterization activity, along with surface characterization, has shown that dangerous waste is not a concern in the unit based on residential cleanup standards. These activities also indicated very low levels of radionuclide contamination. Therefore, only one characterization activity is planned for the 216-B-3A Expansion Pond. One auger hole will be established at the center of the trench dredged in the middle of the pond.

5.1.3.2.4 216-E-28 Contingency Pond. The 216-E-28 Contingency Pond has never been used, and therefore no sampling activities are planned.

5.1.3.2.5 Unplanned Releases. Unplanned Releases UN-200-E-14 and UN-200-E-92 were discussed in Section 2.1 and do not have an impact on the sampling design for the operable unit. Unplanned Release UN-200-E-14 was a dike failure on the east side of the main pond and is now part of the 3A Pond. Unplanned Release UN-200-E-92 consisted of contaminated tumbleweeds that have been removed and disposed. Other unplanned releases associated with the operable unit (e.g., UPR-200-E-34 and UPR-200-E-138) resulted in direct discharges to the waste management units and will therefore be characterized as part of the waste management units.

5.1.3.3 Nonsite-Specific Activities. Nonsite-specific activities include perched water sampling, air sampling, and a pipeline integrity assessment.

5.1.3.3.1 Perched Water Sampling. Five boreholes are planned for the 200-BP-11 Operable Unit investigation, four to 15 m (50 ft) and one to groundwater [about 61 m (200 ft)]. The proposed locations of these boreholes are shown in Figure 4-4. If perched water is encountered in a borehole, a perched water monitoring well will be installed that is screened against the water-bearing interval. Further discussion regarding the installation and sampling of a perched water well is provided in Section 5.1.4.9.

5.1.3.3.2 Air Sampling. Five permanent air samplers are stationed within the 200-BP-11 Operable Unit (see Plate 1). The samplers contain filters, which collect particles entrained in the air. The sample filters are exchanged weekly and saved to be analyzed quarterly. The analyses from these filters will be used to establish a baseline for the air in the operable unit prior to commencing field activities and to assess the overall impacts of field activities to area-wide air quality. This air sampling effort is an ongoing activity, currently managed by Westinghouse Hanford Company, that is independent of the other activities described in this work/closure plan.

During the intrusive field work (e.g., test pits and boreholes) at the 200-BP-11 Operable Unit, the air will be monitored more closely to assess the potential impact of contaminated air inhalation to workers. This will require the usage of portable air samplers to measure potential contamination downwind of the sites. In general, two air samplers will be stationed downwind (based on windroses, Figure 2-2) within 500 m (1,650 ft) of the intrusive sites. The sample(s) at each station will be collected at a height of 2 m (6.6 ft) above ground level and in a location free from unusual localized effects (e.g., near a large building, vehicular traffic, or trees) that could result in artificially high or low concentrations. Additionally, in consideration of borehole and test pit locations, the samplers should be strategically placed to minimize the need to relocate them.

In addition, fugitive dust and volatile organic compound monitoring may be conducted as part of the health and safety program of each work site.

5.1.3.3.3 Pipeline Integrity Assessment. The process effluent pipelines within the 200-BP-11 Operable Unit are depicted in Figure 3-1 and Plate 1. The PUREX Cooling Water Line and the 216-B-3-2 Pipeline are the only pipelines of interest to the operable unit investigation because all other pipelines are active and/or associated with other facilities. Furthermore, these active pipelines convey only clean water as regulated per WAC 173-303 and therefore pose virtually no threat of contaminating the operable unit. A surface radiation survey will be performed over these two pipelines consisting of approximately 700 m (2,300 ft). Two sections of pipe are to be further assessed: the capped PUREX Cooling Water Line leading to the Gable Mountain Pond and the southern segment of the 216-B-3-2 Pipeline. An internal camera and radiation survey will be performed on these portions of pipe if technically and economically feasible. The emphasis of these surveys will be to assess pipeline integrity, identify potential leak points, and attempt to correlate the leak points to potential surface contamination. An assessment for potential soil sampling will be made after these surveys are complete. If areas of probable leaks are detected, an assessment of potential contamination will be performed, and additional soil samples may be taken and analyzed for constituents listed in Table 3-2.

5.1.4 Field Investigation Protocols and Procedures

5.1.4.1 Field Screening. All samples and cuttings will be field screened for evidence of radionuclides and volatile organics.

Radionuclides will be screened using gamma (NaI) radiation detectors and low-level alpha and beta detectors. All instruments will be used, maintained, and calibrated consistent with EII 3.2, "Calibration and Control of Monitoring Instruments" (WHC 1988b), and EII 3.4, "Field Screening" (WHC 1988b).

Prior to initiating drilling, a one-time background reading will be taken using the above instruments at a background site to be determined in the field (e.g., the contingency pond). Instrument background will be measured on freshly disturbed surface soil, holding the instruments less than 2.5 cm (1 in.) from the soil. The field geologist will record the background levels in the borehole log according to EII 9.1, "Geologic Logging" (WHC 1988b), prior to the start of drilling.

Radionuclides will be screened according to EII 3.4, "Field Screening" (WHC 1988b). The field geologist will record screening results in the borehole log [EII 9.1, "Geologic Logging" (WHC 1988b)]. The action level for radionuclide screening is twice background. Readings of less than twice the average background are within the normal background variability for the site and so are not indicative of the presence of anthropogenic radionuclide. Readings over twice background will be assessed as potential surface samples.

The field geologist or other qualified personnel will screen samples and cuttings for volatile organics using either a flame ionization detector or photoionization detector. The relative response ratios of the chlorine-based compounds for either the flame ionization detector or photoionization detector range from 10% for carbon tetrachloride (flame ionization detector) to 105% for 1,1,1-trichloroethane (flame ionization detector). To detect the chlorinated compounds using survey-type instruments under ambient, uncontrolled conditions, the 5-ppm action level provides reasonable confidence in detection of these compounds. The action level for volatile organic screening is 5 ppm. The 5-ppm limit is based on the total volatile organic compounds detected as either benzene or methane equivalents.

5.1.4.2 Surface Radiological Surveys. Surface radiological surveys will be conducted on the waste management units within the 200-BP-11 Operable Unit using gamma (NaI) radiation detectors and beta detectors. Table 5-6 also specifies the units that will receive surface radiological surveys. Surveys will also be run as part of the pipeline integrity assessment task. Unified surveys should be run on units that are historically and geographically related to one another. These unit groupings include the following:

- 216-B-3 Main Pond and 216-B-3-3 Ditch
- 216-B-3-1 and 216-B-3-2 Ditches and the overflow pond

- 216-B-3A Expansion Pond
- 216-B-3B Expansion Pond
- 216-B-3C Expansion Pond.

The approximate limits of each survey can be assessed from the waste management unit boundaries shown on Plate 1. Survey boundaries will be extended until no further contamination is found along the survey boundaries. The smallest area covered (Table 5-2) by the surveys is about 40,500 m^2 (435,600 ft^2) and will therefore be conducted with the Ultrasonic Ranging and Data System (USRADS) or Mobile Service Contamination Monitor II (MSCM-II). The USRADS or MSCM-II will automatically correlate and record count rate, dose rate, and position information during the survey. The pipeline integrity surveys will also utilize the USRADS or MSCM-II.

These surveys will be done primarily to locate areas of elevated surface radiation (above twice background) for potential sampling (Section 5.1.3.1) and to optimize sampling locations for boreholes, test pits, and auger holes. Locations of elevated radiation will be marked in the field and evaluated as sampling locations for subsurface characterization and also as potential surface samples. Prior to the initial surveys, a one-time instrument background will be determined at a background site to be determined in the field. Instrument background will be measured on a freshly disturbed surface soil, holding the instrument less than 2.5 cm (1 in.) from the soil.

Surveys will be conducted by a qualified health physics technician. This individual will be responsible for verifying the proper working condition of the instruments and for recording field measurements in accordance with the applicable health physics procedures. A survey report will be prepared and will include a description of the survey methods used, the survey results, and a list of surface soil sampling location recommendations.

5.1.4.3 Surface Geophysical Surveys. Ground-penetrating radar surveys are planned to locate pipelines and the stabilized 216-B-3-1 and 216-B-3-2 Ditches. A ground-penetrating radar survey will generate a continuous profile of shallow subsurface features by transmitting and then receiving reflected high-frequency radio waves. The ground-penetrating radar may also be used to detect buried objects and voids and to delineate the limits of disturbed ground.

If needed, an electromagnetic survey may be utilized to provide supporting evidence of ditch and pipeline boundaries. An electromagnetic survey will use a transmitter coil to induce eddy currents in the subsurface. The eddy currents generate a secondary electromagnetic field that is measured with a receiver coil. The intensity of these currents is a function of ground conductivity.

These surveys will be performed prior to locating test pits/auger holes for the 216-B-3-1 and 216-B-3-2 Ditches and pipeline integrity assessment because they are nonintrusive and can be used to locate disturbed ground boundaries, buried objects, and backfill depths. This information will be used to help find the ditch boundaries. Specific survey grid coordinates will be established from a minimum of three recoverable reference points, staked and located during a later geodetic survey. Each data point will be designated with a unique number associated with the facility and its grid location. All geophysical surveys will be conducted according to EII 11.2, "Geophysical Survey Work" (WHC 1988b).

5.1.4.4 Source Area Boreholes. Five boreholes [one to groundwater, four to 15 m (50 ft)] will be made during the 200-BP-11 Operable Unit field investigations (Table 5-6). Additional shallow boreholes may be required if conditions prevent the use of test pits and/or auger hole sampling, e.g., radiation may be too high for a test pit, or a test pit/auger hole may reach its maximum depth and still be in contaminated soil. Criteria for the sampling locations and frequencies within boreholes are provided in Section 5.1.3.2.

5.1.4.4.1 Borehole Drilling. The boreholes will be sited to avoid buried obstructions and if hot spots persist, in areas that appear most contaminated. Before drilling commences, an offsite utility check should be performed. In all cases, drilling will also be preceded by a surface radiation survey of the area and, at some locations (Table 5-1), surface geophysics. If a boring encounters contamination at such high levels that it cannot be continued as determined by health physics personnel, it should be abandoned according to the procedures outlined in EII 6.10, "Decommissioning Wells" (WHC 1988b), and a new boring located per the direction of the operable unit task lead and field team leader.

The drilling technique used on the boreholes will be the cable-tool method or other acceptable drilling technique. Drilling operations will be conducted according to WHC-S-014, "Generic Well Specification for Groundwater Monitoring Wells" (Hodge 1990), and EII 5.4, "Field Cleaning and/or Decontamination of Equipment." A short drive barrel sampler [0.6 m (2 ft) maximum length] will be used to remove soils (slough and/or undisturbed material) from the borehole between sampling intervals. Hard-tool drilling will be initiated only as a last resort when drilling conditions are not conducive to the use of the drive barrel. The decision to drill with the hard tool will be made by the drilling field team leader only after consultation with the field geologist and/or the project coordinator.

As drilling proceeds, the field geologist will be responsible for completing the borehole geologic log. The borehole geologic log will be completed according to EII 9.1, "Geologic Logging" (WHC 1988b). The geologic log will contain sample type and depth, lithologic description, and any other geologic information the field geologist believes is pertinent to the characterization of the subsurface stratigraphy.

If perched water is encountered in a boring, a perched water well will be installed that is screened against the water-bearing interval. Any of the four 15-m (50-ft) boreholes that do not encounter perched water will be abandoned. The groundwater borehole will also be abandoned unless it is assessed for use as a groundwater monitoring well. Holes will be abandoned according to the procedures outlined in EII 6.10, "Decommissioning Wells" (WHC 1988b). Perched water wells will be installed after the boreholes have been advanced to the proper depth. The design and specification of these wells will be according to the information presented in WHC-S-014 (Hodge 1990). In general, the wells will be constructed of 0.1-m- (4-in.) inner diameter 304 stainless steel, joint-threaded casing, and wire-wrapped well screen. The screen slot and pack sand size will be determined from the results of sieve analyses in the screened interval. The wells will be installed in accordance with WHC-S-014, "Generic Well Specification for Groundwater Monitoring Wells" (Hodge 1990).

5.1.4.4.2 Borehole Sampling. Chemical, physical, and archive samples will be collected from each borehole. The split-spoon sampler will be the primary device for collecting these samples. All split-spoon sampling depths will be recorded to the nearest 0.025 m (0.10 of a foot). All depths will be recorded to the nearest 0.025 m (0.10 of a foot). The chemical, physical, and archive sampling intervals are unit- and depth-specific and are described along with the individual boreholes in Section 5.1.3.2. The sampling intervals are approximate depths only and may be modified at the discretion of the onsite geologist based on observed lithologic changes and/or hot spots. If perched water is encountered in a boring, the sampling interval should be modified such that at least one chemical and physical sample is collected in the saturated zone. Sample intervals may be extended by driving the split-spoon sampler a second time if an insufficient sample volume is collected during the first attempt.

All samples and cuttings will be field screened for evidence of volatile organics and radionuclides per Section 5.1.4.1. The action level for radionuclide and volatile organic screening is twice background and 5 ppm, respectively (Section 5.1.4.1). These action levels will typically trigger a readiness for sampling.

Chemical samples will be collected in accordance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988b). Sample container types, preservation requirements, and special handling requirements are also defined in EII 5.2. Analytical services may require the use of sample authorization forms to further define there requirements. Chemical samples will be collected with a split-spoon sampler with stainless steel liners. To ensure that the sample is not compressed, drilling personnel will not overdrive the sampling device. The split-spoon and liners will be decontaminated before use according to EII 5.5, "Laboratory Cleaning of RCRA/CERCLA Sampling Equipment" (WHC 1988b). Prior to sampling, slough in the borehole will be removed to the greatest extent possible. Sampling personnel will preserve the samples in accordance with the EPA guidelines set forth in *Test Methods for Evaluating Solid Wastes* (EPA 1986). All chemical samples will be geologically logged by the field geologist. Chemical samples will be labeled with the appropriate Hanford Environmental Information System (HEIS) number to accommodate sample tracking and data entry into the HEIS system. Quality assurance requirements are discussed in Appendix A.

Physical samples will be collected from boreholes only and by the same procedures as for chemical samples. All of the physical samples will undergo a Type A set of physical analyses, but a sample from each major lithology (as determined by the field geologist) will also undergo a Type B set of physical analyses. Both suites of physical analyses are described in Section 5.1.5.2.

The samples must be collected and transported in a manner that preserves the original moisture content and soil structure. Type A samples will be collected in sample sleeves. Samples for moisture content will be collected in moisture tins or mason jars. Every effort should be made to maintain the sample in the sleeve in an undisturbed state, and the sleeve must be as full as possible.

Portions of physical samples that have been unconditionally radiologically released will be sent to an existing storage facility to be archived. Radiologically contaminated samples will be sent to a long-term storage facility if one is available. If no long-term storage facility is available for radiologically contaminated samples, no contaminated samples will be taken for archive. The unconditionally radiologically released samples will be archived according to EII 5.7A, "Hanford Geotechnical Sample Library Control" (WHC 1988b).

5.1.4.4.3 Borehole Analytical Priorities. Physical and chemical samples are generally grouped together so that the two sets of data may be compared. Chemical samples will always take precedence over physical samples, which take precedence over archive samples. Additionally, if there is insufficient sample size, the priority for sample analyses is as follows:

RCRA Past-Practice and TSD units	Perched Water
Radionuclides	Radionuclides
Metals	Metals
Semivolatile organics analysis	Volatile organics analysis
Volatile organics analysis	Semivolatile organics analysis
General chemistry	General chemistry
Physical	Physical

Note that these priorities are the same for both RCRA past-practice and RCRA TSD waste management units.

5.1.4.5 Backhoe Test Pits and Auger Hole. Backhoe test pits are planned at the 216-B-3-1 and 216-B-3-2 Ditches and the overflow pond. Auger holes may be used instead of test pits and are also planned at the other waste management units. The depth of these test pits/auger holes are planned to be 6 m (20 ft) below the ditch/pond sediments. Fill material (stabilization soil) may be about 3 m (10 ft) deep, making the total depth of a test pit about 9 m (30 ft). The maximum depth that can be reached in a test pit is about 12 m (39 ft).

The excavation field work for test pits will be conducted using a crawler-mounted backhoe on a full revolving base or other appropriate equipment. The excavations will be made at the center of the overflow pond, and across the ditches.

An area designed specifically for taking samples from the backhoe bucket will be designated at least 9 m (30 ft) away from the excavation pit within reach of the bucket. Samples will be collected from the backhoe bucket using hand tools and standard soil sampling techniques identified in EII 5.2, "Soil and Sediment Sampling, Appendix I Test Pit/Trench Sampling" (WHC 1988b). Samples will be logged by a geologist. After the test pit has been completed, it will be backfilled with the excavated material. This action will require regulator approval and will be discussed in more detail in descriptions of work. Such approval has been granted at other Hanford study areas in the past.

5.1.4.6 Subsurface Geophysics. Subsurface geophysics (RLS) will be run on the new boreholes as each casing string reaches its maximum depth. Boreholes will be logged according to EII 11.1, "Geophysical Logging" (WHC 1988b). A description of the typical equipment configuration, calibration, and acquisition parameters for this technique is presented in the QAPjP (Appendix A). Spectral gamma logs (RLS) will also be performed on the following 12 existing monitoring wells:

- 699-40-39
- 699-40-40A
- 699-41-40
- 699-42-39B
- 699-42-40A
- 699-42-41
- 699-43-41F
- 699-43-42J
- 699-43-43
- 699-44-42

- 699-44-43B
- 699-43-45.

These wells were selected for logging because they are located within or adjacent to waste management units associated within the 200-BP-11 Operable Unit. If analysis of data from these 12 wells indicate that spectral gamma logging provides useful information, a second round of spectral logging may be instituted. The extent of the second round of spectral logging will be assessed and scheduled after evaluation of the initial loggings. Data from these existing wells may also be used to refine the sampling intervals at nearby proposed wells.

The RLS spectral gamma logs will be run on each new hole to provide an in situ spectral analysis. Gamma-gamma and neutron-epithermal-neutron logs will also be run if the technology is available at the time of the field work. These two techniques can give valuable information on the stratigraphy and water content of the units adjacent to the borehole.

Although most groundwater monitoring wells in the operable unit have been logged for gross gamma, only one well (699-40-40B) was logged for specific activities with the spectral gamma method. No anthropogenic radionuclides were detected (WHC 1991c). Logging should be conducted at the other wells in the future.

5.1.4.7 Surface Soil Sampling. Surface soil samples may be collected at the waste management units indicated in Table 5-6. The actual number and locations of samples collected at the waste management units will depend on the results of surface radiation surveys (Section 5.1.3.1). Samples will be collected from the most contaminated areas exceeding action levels (twice background) as identified by the radiation surveys. If two or more separate and distinct contaminated areas are identified during a given survey, more than one sample may be collected. At waste management units that have been surface stabilized, samples should not be collected unless radionuclide contamination is indicated above action levels by surface radiation surveys. At waste management units that have not been surface stabilized, at least one sample should be collected even if the surface radiation survey does not identify contamination. Such a sample should be collected at the approximate center of the unit. If contamination is detected, the determination of the sampling locations should be made during the surface radiation surveys and is described in more detail in Section 5.1.3.1.

Samples will be collected with a stainless-steel shovel. Surface soil samples will be collected according to EII 5.2, "Soil and Sediment Sampling" (WHC 1988b). The analyses that each sample will undergo are further described in Section 5.1.5. Each sample will be sent to the appropriate controlled facility (i.e., 222-S Laboratory) for classifications before being sent to a laboratory for analysis. Quality assurance requirements are discussed in Appendix A.

5.1.4.8 Pond and Ditch Bottom Sampling. Sampling of the 216-B-3-3 Ditch, main pond, and expansion pond bottoms was performed during Phase 1 and 2 activities in support of the *216-B-3 Expansion Ponds Closure Plan* (DOE-RL 1993b). The results of these sampling events are summarized in Section 3.1 and more completely in Appendices C, D, and E of the 216-B-3 Expansion Pond Closure Plan (DOE-RL 1993b). Currently, surface water remains in only the 216-B-3C Expansion Pond, and only the "bottoms" of the 216-B-3A and 216-B-3B Expansion Ponds are exposed. Therefore, since the Expansion Ponds are being clean closed, no direct pond and ditch bottom sampling will occur in the operable unit. However, the buried pond and ditch bottoms will be sampled in conjunction with borehole, test pit, and auger hole sampling.

5.1.4.9 Perched Water Sampling. If perched water is encountered in sufficient quantity during borehole drilling, a well will be installed in the perched water zone and the perched water sampled. Perched water sampling will be conducted according to the protocols listed in EII 5.8, "Groundwater Sampling" (WHC 1988b). Temperature, pH, turbidity, and electrical conductivity will be monitored during the purging of each well. Turbidity is normally not required per EII 5.8, but will be required to evaluate if the perched water is derived from the aquifer. Wells will be purged until a minimum of three well and sand pack pore space volumes have been removed, all parameters have stabilized, or the well is dry. Purged groundwater will be collected and disposed as described in EII 10.3, "Purgewater Management" (WHC 1988b). Normally, one perched water sample will be taken. However, for inorganics, two samples will be collected per well instead of one; one will be unfiltered, and a second will be filtered through a 0.45-micron filter onsite before being bottled and preserved. Only an unfiltered sample will be required for organic analyses. Samples will be labeled with the well designation, an indication of the filtration, and the date of collection.

Perched water level measurements will be taken monthly and before the wells are purged and sampled. These data will be used to evaluate water level fluctuations and to establish horizontal perched water gradients. The vertical gradients within the perched water zone will not be studied. Horizontal gradients will be measured if possible. These data will also be used to determine the amount of water that needs to be purged from each well before it is sampled. All measurements will be conducted according to EII 10.2, "Measurement of Groundwater Levels" (WHC 1988b).

5.1.4.10 Air Sampling. Five permanent air samplers (see Plate 1) currently managed by Westinghouse Hanford Company will be utilized for the 200-BP-11 air sampling program. The air samples are collected by drawing ambient air through a 47-mm (2 in.) open-face filter at a flowrate of 0.056 m^3/min (2 ft^3/min) about 1 m (3 ft) above the ground. Throughout the 200 Areas, air samplers are operated on a continuous basis. Sample filters are exchanged weekly, held 1 week to allow for decay of short-lived natural radioactivity, and sent for initial laboratory analyses of gross alpha and beta activity. After the initial analysis, the filters are stored until the end of the calendar quarter, at which time they are composited by sample location (or deemed as appropriate according to the annual reports) and sent for laboratory analyses of specific radionuclides. In 1993, the radionuclides reported were Be-7, CePr-144, Co-60, Cs-134, Cs-137, Eu-154, Eu-155, K-40, Pu-238, Pu-239/240, Ru-106, Sb-125, Sr-90, U-234, U-235, U-238, Zn-65, and ZrNb-95. Compositing of the filters by sample location provides a larger sample size, and thus a more accurate measurement of the concentration of airborne radionuclides resulting from operations in the 200 Areas. The most recent yearly composite analysis of air filters from the 200-BP-11 Operable Unit area will be used as the baseline for the air sampling program.

Portable air monitors will maintain the same protocols and procedures as the permanent air monitors, except final compositing of the samples will occur prior to relocating the samplers, with analyses to be performed as soon as possible thereafter.

If further air monitoring is required for personal health and safety , the monitoring equipment procedures and protocols will be specified or referenced in future safety documentation (e.g., Safety Analysis Documents and Hazardous Waste Operations Plans).

5.1.4.11 Pipeline Integrity Assessment. The only pipelines of interest for this assessment are approximately 1,150 m (3,700 ft) of the PUREX Cooling Water Line (see Figure 3-1 and Plate 1) and the 216-B-3-2 Pipeline. All other pipelines are active and transport only clean water. A surface radiation survey will be run over the top of, and 5 m (17 ft) to each side of the pipelines. The survey will be increased if contamination is noted on the survey boundaries. The surface vey will be conducted with USRADS or MSCM-II. The radiation survey will be cording to the protocols described in Section 5.1.4.2. If radioactivity is encountered, amples may be collected from the most contaminated areas.

ıra and radiation surveys will be performed inside of the inactive portion of the pipelines, ined technically or economically unfeasible. The emphasis of these surveys will be to r leak points in the lines, to attempt to correlate leak points to surface contamination, the selection of potential test pit locations.

nding on the extent of contamination, test pits (or auger hole) may be excavated along ificant leak points identified by the previous surveys. However, test pits are not ound the pipelines. If a test pit is utilized, the test pit(s) will be dug to a depth of y 6 m (20 ft), and between one and three samples may be collected from each pit. The d sampling procedures for the test pits are the same as those described in .5.

nple Designation and Handling. Field logs will be maintained to record all field and activities according to EII 1.5, "Field Logbooks" (WHC 1988b). Samples for alysis will be taken at five waste management units and along one pipeline within the perable Unit as indicated in Tables 5-2 and 5-6. These will be placed in appropriate d properly preserved. All samples for laboratory analysis will be transported under ›dy in accordance with EII 5.1, "Chain of Custody" (WHC 1988b), and EII 5.11, aging and Shipping" (WHC 1988b). The analysis of the soil and source samples will nination of radiological, chemical, and physical characteristics.

IEIS is used to track the sample and laboratory data obtained during these investigations. will be identified and labeled with a unique HEIS sample number in the field. The s will be assigned in the field according to EII 5.10, "Obtaining Sample Identification Accessing HEIS Data" (WHC 1988b). The sample location and corresponding HEIS be documented in the field logbook.

ontamination Equipment and Procedures. Decontamination procedures have been r the Hanford Site by BHI and are provided in the *Environmental Investigations and Site ion Manual* (WHC 1988b), which includes decontamination requirements and specific adiological and nonradiological contamination. EII 5.4, "Field Cleaning and/or ion of Equipment" (WHC 1988b), establishes methods for cleaning and/or ng tools and equipment used in site characterization and monitoring activities. EII 5.5, Cleaning of RCRA/CERCLA Sampling Equipment" (WHC 1988b), applies to the mpling equipment used for RCRA/CERCLA sampling before the equipment is taken and to equipment used to collect samples for both physical and analytical testing. not apply to cleaning equipment that is used to collect samples for physical testing; such cleaned in accordance with EII 5.4.

ment decontamination will occur in conjunction with most of the sampling activities 200-BP-11 Operable Unit. The methods will generally consist of washing or steam a detergent/water or other decontamination solution. Field decontamination of drilling here applicable, shall be performed within impoundments in the decontamination zone to l wash liquids are captured. All wash liquids used for decontamination purposes must be properly disposed of according to applicable state/federal regulations. Drilling and backhoe equipment will be decontaminated before use on another borehole as required to ensure the safety of personnel and prevent cross-contamination of samples.

5.1.4.14 Investigation Derived Waste. Investigation derived waste generated by field investigation and CMS activities will be managed according to EII 4.2, "Interim Control of Unknown, Suspected, Hazardous and Mixed, and Radioactive Waste" (WHC 1988b), or as agreed upon by the cognizant regulators (DOE, EPA, Ecology). If investigation derived waste is managed according to EII 4.2, the following exception to the procedure applies: because of excessive turnaround times between sample submittal to the laboratories and receipt of sample analysis, if the 90-day clock (waste generation to disposal) is determined by the cognizant regulators to be appropriate for the RFI/CMS, the clock will not begin until generator receipt of the sample analyses results used for waste designation purposes. The samples collected for the field investigation study will be sufficient for waste designation and waste management unit characterization.

5.1.4.15 Geodetic Surveys. Geodetic surveys will apply to almost all the tasks required to complete the operable unit characterization and will occur at most of the waste management units within the operable unit (see Table 5-6). Surveys are to be completed by a licensed surveyor, registered in Washington State. Surveyors will be accompanied, at least initially, by the field team leader (or designee) to familiarize the surveyors with specific locations. At least two controls will be referenced to a National Geodetic Survey datum obtained from a permanent bench mark. The North American Datum (NAD) 1983 (Lambert Projection) will be used for horizontal control and the North American Vertical Datum (NAVD) will be used for vertical control.

Horizontal (x,y coordinates) locations of surface soil samples and the corners of surface geophysical surveys, and surface radiation surveys will be professionally surveyed. Horizontal and vertical locations (x, y, z coordinates) will be professionally surveyed for those soil boreholes that have a well screen installed. Abandoned boreholes, test pits, and auger holes will also be surveyed.

5.1.5 Laboratory Analysis

Surface soil samples, vadose zone soil samples (from boreholes, test pits, and auger holes), and perched water samples will be sent for chemical analysis. Air monitoring samples collected from the air samplers are controlled under a separate program and are typically analyzed for cesium-60, strontium-90, plutonium-238, plutonium-239, plutonium-240, uranium, gross alpha, and gross beta. Only borehole soil samples will be sent to the laboratory for physical analyses. Table 5-7 summarizes the types of samples that will be collected from each of the waste management units and the general chemical analyses. The analyses are described in greater detail in Sections 5.1.5.1 and 5.1.5.2.

5.1.5.1 Chemical Analyses. Table 5-7 lists the contaminants of concern for the 200-BP-11 Operable Unit, practical quantitation limits (nonradioactive) and minimum detection limits (radioactive), and the suggested analytical method. For some of the analytes, the contract laboratory may have to use a different analytical method than the suggested one, which is acceptable as long as the alternate method is approved by Ecology.

If an insufficient sample exists to perform all of the analyses, the analyses must be prioritized in the order they are listed on the table (Table 5-7, footnotes b,e). The concentrations of many of the radionuclide contaminants of concern (Table 3-2) will be calculated from parent or daughter relationships. The radionuclides whose concentrations will be calculated in this way are listed in Table 3-2 and on the bottom of Table 5-7 (footnote a).

For the following reasons, the list of contaminants of concern may be modified for some samples.

(1) Surface soil samples will not be analyzed for volatile organics. These compounds are unlikely to persist in near-surface conditions.

(2) To facilitate Ecology's concerns regarding known and suspect contamination (Section 3.1), the TSD unit (main pond, 216-B-3-3 Ditch, and overflow pond) will be analyzed for a "modified" 40 CFR 264 Appendix IX groundwater monitoring list. The modified Appendix IX list is defined as the Appendix IX analytes minus phosphorous pesticides (method 8140), herbicides (method 8150), dioxins (method 8280), and non-halogenated volatile organics (method 8015).

(3) Perched water samples will be analyzed for the contaminants of concern listed in Table 5-7, the Modified Appendix IX list, and three additional analytes: fluoride, carbon-14, and tritium. In addition, each water sample will undergo radionuclide and inorganic analyses on both filtered and unfiltered samples.

5.1.5.2 Physical Property Analyses. Samples will be collected from boreholes to analyze physical properties in support of computer modeling and calculations of contaminant transport. For the purpose of this work/closure plan, physical properties are defined as the environmental and soil properties needed to evaluate the "physics" of contaminant transport, which include pH, moisture content, calcium carbonate content, organic carbon content, and mineralogy. Samples for physical analyses will be divided into two suites: Type A analyses will be performed on all samples from the boreholes and involve a limited number of analyses. Type B analyses will be collected from each major lithology (field geologist's decision) within the borehole and require a comprehensive set of analyses. The samples will be analyzed using American Society for Testing and Materials methods, Soil Science Society of America Standards, and/or DOE approved procedures such as WHC-IP-0635, *Geotechnical Engineering Procedures Manual* (WHC 1991a).

The following physical analyses will be run on Type A samples:

- Particle density
- Particle size distribution
- Bulk density
- Particle size distribution
- Moisture content
- pH
- $CaCO_3$ content.

The following physical analyses will be run on Type B samples:

- The five Type A analyses listed above
- Saturated hydraulic conductivity
- Unsaturated hydraulic conductivity
- Matric potential and soil moisture retention curves (for unsaturated samples only)
- Cation exchange capacity
- Organic carbon content
- If possible, Eh (soil oxidation/reduction potential)
- Mineralogy.

5.1.6 Data Evaluation (Task 7)

Data generated during the field investigation will be integrated, evaluated, and coordinated with other corrective measure activities. The results of certain field activities will be evaluated immediately because they will influence the later field investigation activities. These include data from surface radiological, surface geophysics, and pipeline camera surveys. Data from other field investigation activities will undergo an initial review as they become available. All information generated during the field investigation will be integrated and evaluated for the field investigation report. An important part of this review will be the QRA. The results of these evaluations will be provided in Volume 2 of this document.

5.1.7 Qualitative Risk Assessment (Task 8)

For RCRA past-practice units, the field investigation premise is that it is not necessary, in all cases, to extensively characterize a site before cleanup decisions can be made. However, RCRA TSD units tend toward a more extensive site characterization to justify corrective measure decisions. Also, RCRA TSD units do not currently implement risk assessments in their corrective measure logic. However, a QRA will be scheduled to be performed on all units in the operable unit, including the TSD units. The results of the QRA will be provided in Volume 2 of this document.

A QRA is defined in the *Hanford Site Past-Practice Strategy* as "a judgment not based solely on quantification, agreed to by the parties, based upon available site data regarding the threat posed by site contamination" (DOE-RL 1991b). A QRA may be performed on the basis of existing site data or may be performed following evaluation of field investigation data, and is intended to support the justification and implementation of the corrective measures. Qualitative risk assessments will be conducted in accordance with the guidance provided in the *Hanford Site Baseline Risk Assessment Methodology* (DOE-RL 1993e). The industrial exposure scenario will be adapted for the operable unit and is based on the specific physical and chemical characteristics of the site, applicable transport pathways, exposure routes, and receptors.

Although qualitative assessments impose less stringent requirements for data quality, data collected during the field investigation is expected to possess the level of quality required by the quantitative baseline risk assessment. Qualitative risk assessment for the operable unit will be divided into three groups of units: (1) the 216-B-3 Main Pond, overflow pond, and 216-B-3-3 Ditch; (2) the 216-B-3-1 and 216-B-3-2 Ditches; and (3) the 216-B-3A, 216-B-3B, and 216-B-3C Expansion Ponds.

One of the initial steps in proceeding with corrective measure decisions for the operable unit will be performance of a QRA to better assess the potential risks associated with the site based on previous data and future field investigation data. The qualitative assessment will use the data as input and obtain risk assessment results that should be definitive of the potential risks associated with the operable unit. The risk assessment results will then be used to help support risk-based target concentrations for the operable unit past-practice unit and TSD facility closure activities.

The QRA results will also be useful for judging the adequacy of existing data. Data gaps exist regarding the nature and extent of many potential contaminants. The need for further sampling and analyses that characterize previously unmeasured potential contaminants, primarily nonradioactive organic and inorganic compounds, will be evaluated in light of the QRA results. Additional characterization effort may unnecessary if the risk assessment results indicate that these other potential contaminants are not likely to contribute to overall risks, or that a few of the most significant contaminant concentrations are adequate predictors of less important contaminant levels.

If additional characterization data are needed, they will be collected and input to a qualitative reassessment of potential risks and target contaminant levels. Because the field investigation will produce a wealth of data to refine the conceptual model, the QRA tools will remain available throughout the corrective measure process.

5.1.8 Identification of Potential Action-, Contaminant-, and Location-Specific Corrective Measure Requirements (Task 9)

The formulation of operable unit-specific CMRs is an ongoing process throughout the field investigation and CMS. CMRs were identified (as ARARs) in the B Plant AAMS Report (DOE-RL 1993c) and are summarized in Section 3.3. In addition, potential CMRs for the 200 East Area are being currently developed. Following the evaluation of analytical data under Task 7, potential contaminant-specific and location-specific CMRs will be reviewed based on the new knowledge of contamination at the site and the site setting. Once the potential CMRs for the 200-BP-11 Operable Unit have been properly identified, EPA and Ecology will be asked to verify the potential action-, contaminant-, and location-specific CMRs.

5.1.9 Field Investigation Report (Task 10)

An interim field investigation report will be prepared upon completion of the field investigation. This report will consist of a preliminary summary of the characterization activities described in Tasks 1 through 9 and will be provided in Volume 2 of this document. Information pertinent to the operable unit conceptual model will be refined, as necessary. The report will include the results of source investigations; identify the nature and vertical extent of contamination at the liquid waste disposal facilities; identify the potential action-, contaminant-, and location-specific CMRs; and provide a qualitative assessment of the risks associated with the sites. The report will include an assessment of the need for corrective measures at each site and will make recommendations on the corrective measures that should be implemented.

5.2 CORRECTIVE MEASURES STUDY

Based on the *Hanford Past-Practice Strategy* (DOE-RL 1991b), as outlined in Chapter 1.0, several paths exist that lead to a CMS. The CMS is conducted based on interim EPA guidance (EPA 1988b).

As outlined in Chapter 1.0, candidate waste management units for IRMs have been selected (all units are IRM candidates except the unplanned releases, which are remedial investigation candidates). However, the intent of this work/closure plan is to bypass the IRM process and go directly to the final corrective measure for the units. The data required to select a corrective measure for these units will be gathered during the field investigation. The data obtained from the field investigation will then be used for corrective measure selection in the CMS.

The above strategy applies to both RCRA past-practice and RCRA TSD units. During the CMS process, the study will identify and address specific issues regarding the RCRA past-practice and RCRA TSD integration. The CMS will be provided in Volume 3 of this document.

5.2.1 Alternatives Development

The objective of the CMS is to develop a range of potential corrective measure alternatives that are protective of human health and the environment based on refinement of the preliminary remedial alternatives developed in the B Plant AAMS Report [Chapter 7.0 (DOE-RL 1993c)], data gathered during the field investigation, and the results of the QRA. The CMS will develop alternatives based on the information obtained from the field investigation (i.e., contaminant types and geologic characteristics), and will then evaluate or screen the alternatives against three criteria: effectiveness, implementability, and relative cost. Those alternatives rating highest after screening will be carried over to the corrective measure analysis.

The general identification of remedial action objectives, general response actions, remedial technologies, and a preliminary list of remedial alternatives for the 200-BP-11 Operable Unit are presented in Chapter 7.0 of the B Plant AAMS Report. Remedial action objectives will henceforth be referred to as corrective measure objectives (CMOs) to maintain unity in terminology. These response actions, technologies, and alternatives are considered preliminary and will be modified, as appropriate, based on the evaluation of field investigation data and the QRA. This section discusses how these preliminary identified corrective measures will be refined following EPA guidance (EPA 1988a). The development of corrective measure alternatives will be accomplished in the following steps:

- Refinement of preliminary CMOs
- Development of preliminary general response actions
- Final identification of potential remediation technologies
- Evaluation of process options for each remediation technology
- Assembly of final corrective measure alternatives
- CMR refinement.

Each step is summarized below. Additional details can be found in EPA's interim final remedial investigation/feasibility study (RFI/CMS) guidance document (EPA 1988a).

5.2.1.1 Refinement of Preliminary Corrective Measure Objectives. The preliminary CMOs will be re-evaluated and finalized to discuss environmental medium-specific or source-specific goals for protecting human health and the environment. The environmental media of concern are surface soil, surface water, vadose zone soil, perched groundwater, air, and biota. Contaminants of concern, exposure routes, receptors, and acceptable contaminant levels or ranges of levels for each exposure route will be specified for each medium at each site. Acceptable contaminant levels will be based on identified chemical-specific CMRs, advisory and/or TBC criteria, or results of the QRA.

5.2.1.2 Development of Final General Response Actions. Final general response actions, which are broad classifications of actions or combinations of actions that will satisfy the CMOs, will be developed from the preliminary general response actions on a medium-specific basis. Examples of general response actions are no action, institutional controls and monitoring, disposal, extraction, excavation, containment, and treatment. The waste management units and waste characteristics for the 200-BP-11 Operable Unit for which the general response actions are appropriate will be evaluated as part of this task. Considered in this evaluation will be the radiological, chemical, and physical conditions to which general response actions might be applied.

5.2.1.3 Final Identification of Potential Corrective Measure Technologies. A final list of potential corrective measure technologies will be developed for each identified general response action. A preliminary list of some applicable technologies is presented in Chapter 7.0 of the B Plant AAMS Report (DOE-RL 1993c). The identified technologies and process options may not all be suitable for use at the 200-BP-11 Operable Unit. First, the identified options will be evaluated for technical implementation. This is determined by comparing the capabilities of each process option to the physical and chemical characteristics of the waste management units within the operable unit. Sometimes an entire technology may be eliminated because its process options are not technically implementable. The rationale for screening each remediation technology will be documented.

5.2.1.4 Evaluation of Process Options. Once identified, options are evaluated for technical implementation. The second step involves a closer evaluation of the process options associated with each remaining technology. Process options will be evaluated on the basis of effectiveness, implementability, and relative cost.

The effectiveness evaluation will focus on the following:

- The potential effectiveness of the process options in handling the estimated areas or volumes of the contaminated medium and attaining the CMOs for that medium

- The degree that human health and the environment may be compromised during construction and implementation required by the process option

- How proven and reliable the process option is with respect to the contaminants and conditions at the waste management units within the 200-BP-11 Operable Unit.

Both technical and institutional implementability are considered in evaluating process options. Technical implementability will eliminate those options that are clearly ineffective or unworkable at the 200-BP-11 Operable Unit. Institutional considerations include the ability to obtain necessary permits for any offsite actions; the ability to meet substantive requirements of relevant permits for onsite actions; the availability and capacity of appropriate treatment, storage, and disposal services; and the availability of essential equipment and skilled labor.

Cost will be an evaluation criterion. Relative order-of-magnitude capital, operations, and maintenance costs, as opposed to detailed estimates, will be determined based on engineering judgement. Processes within the same technology type will be compared with respect to cost.

Innovative technologies may be applicable at the 200-BP-11 Operable Unit. Should an innovative technology exhibit fewer environmental impacts, better treatment, or lower costs over a conventional technology, it could progress through the screening process.

Applicable technologies with one or more feasible process options will be used in developing corrective measure alternatives. Multiple process options based on one technology may be chosen if they are significantly different and the result of one would not adequately represent the other. If possible, one representative process from each technology will be selected to simplify the subsequent development and evaluation of alternatives without limiting flexibility during corrective measure design. Process options that are not selected for development, generally, will not be considered later in the CMS. However, they may be reinvestigated during corrective measure design if the associated technology is selected for implementation at the 200-BP-11 Operable Unit.

5.2.1.5 Assembly of Corrective Measure Alternatives. Preliminary alternatives will be re-evaluated and further developed for each contaminated environmental medium of concern based on the results of the field investigation and the QRA. This will involve assembling medium-specific process options, remedial technologies, and general response actions.

Section 121(b)(1) of CERCLA has a statutory preference for permanent treatment and waste volume reduction. This is also the preference for RCRA TSD units. However, as described in 40 CFR 300.430 (e)(9)(iii) of CERCLA, nine criteria are to be considered in the evaluation for remedial selection: (a) overall protection of human health and the environment; (b) compliance with ARARs; (c) long-term effectiveness and permanence; (d) reduction of toxicity, mobility, or volume through treatment; (e) short-term effectiveness; (f) implementability; (g) cost; (h) state acceptance; and (i) community acceptance. Therefore, a remedy that involves treatment and waste volume reduction will not necessarily be the preferred alternative. Additionally, for the initial screening evaluation of alternatives (Section 5.2.2.2), the major considerations will be long- and short-term effectiveness, implementability, and cost. After the initial screening of alternatives, a detailed screening using all nine criteria will be performed (Section 5.2.3.2) to select final corrective measures.

5.2.1.6 Corrective Measure Requirements Refinement. A preliminary identification of potential CMRs (ARARs) was developed as part of the B Plant AAMS Report (DOE-RL 1993c, Chapter 6.0). These CMRs will be re-examined after the corrective measure alternatives have been assembled to eliminate options that are not desirable or feasible based on regulatory requirements.

5.2.2 Corrective Measure Alternatives Screening

Screening follows the development of alternatives and precedes analysis. The objective of screening the alternatives is to reduce the list of potential corrective measure alternatives to a manageable level. The potential corrective measure alternatives will be evaluated in greater detail, based on effectiveness, implementability, and cost. The optimal alternatives that best attain the CMOs will then be retained for detailed analysis.

The following is a summary of the alternative screening process. Further details can be found in the draft RI/FS (RFI/CMS) guidance (EPA 1988a).

5.2.2.1 Refinement of Corrective Measure Alternatives. The corrective measure alternatives will be further refined to identify details of process options, process sizing requirements, time frames, and the ability to attain the CMOs. The field investigation information will more accurately identify the nature and extent of contamination so that suitable equipment, technologies, and process options can be evaluated.

The specific types of information that will be developed under this task for the technologies and process options used in each alternative will be as follows:

- Size and configuration of onsite removal and treatment systems
- Identification of contaminants that impose the most demanding treatment requirements
- Size and configuration of containment structures
- Time frame in which treatment, containment, or removal goals can be achieved
- Treatment rates or flow rates associated with treatment processes
- Special requirements for construction of treatment or containment structures, staging construction materials, or excavation
- Distances to disposal facilities
- Required permits and imposed limitations.

All information and assumptions used in generating this information will be thoroughly documented during the CMS (Volume 3).

5.2.2.2 Screening Evaluation of Alternatives. The corrective measure alternatives will be screened with regard to the short- and long-term effectiveness, implementability, and cost. An evaluation of innovative alternatives will also be made and comparisons will be made among similar alternatives. The most promising alternatives will be carried forward for further analysis, and then distinctions across the entire range of alternatives will be made.

Alternatives will be retained that have the most favorable composite evaluation. The selections, to the extent practicable, will preserve the range of appropriate alternatives based on the general response actions. Four or fewer alternatives for the waste management units within the 200-BP-11 Operable Unit are expected to be retained. Additional alternatives may be needed if offsite disposal, as opposed to operable unit-specific, alternatives are developed and preferred. Alternatives not selected may be reconsidered if new information shows additional advantages.

5.2.2.2.1 Effectiveness Evaluation. Each alternative will be evaluated on the basis of its ability to protect human health and the environment through reductions in toxicity, mobility, or waste volume. Short-term protection needed during the construction and operation period, and long-term protection needed after completion of the corrective measure alternative, will be evaluated. Sensitivity analyses will be prepared to evaluate probable performance.

Residual contaminant levels remaining after a reduction of waste toxicity, mobility, or volume will be compared to contaminant-specific CMRs, pertinent to consider values, and levels established through risk assessment calculations.

5.2.2.2.2 Implementability Evaluation. Implementability is a measure of both the technical and institutional feasibility of accomplishing an operable unit remedial alternative. Technical feasibility refers to the ability to construct, operate, meet action-specific CMRs, and maintain and monitor the technologies or process options. Institutional feasibility refers to the ability to obtain approvals from appropriate agencies and to procure required services, equipment, and personnel.

Alternatives deemed not technically feasible will be dropped from consideration. If agency approval is necessary for an institutionally infeasible alternative, the alternative will not be dropped from further consideration. In the latter situation, the remedial alternative will be retained, if possible, with the incorporation of appropriate coordination steps needed to lessen its negative aspects.

5.2.2.2.3 Cost Evaluation. Comparative cost estimates will be made. Cost estimates will be based on cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates. Both capital and operating and maintenance costs will be considered where appropriate. Current-worth analyses will be used to evaluate expenditures that occur over different time periods, so the costs for different remedial alternatives can be compared on the basis of a single figure for each.

5.2.2.2.4 Evaluation of Innovative Alternatives. Innovative technologies will be considered if they are fully developed but lack sufficient cost or performance data for routine use. It is unlikely that alternatives that incorporate innovative technologies will be evaluated as thoroughly as is done with available technologies. However, innovative technologies will pass through the screening phase if they offer promise of significant advantages. The need for treatability studies on retained innovative technologies will be determined in conjunction with the evaluation of data needs.

5.2.2.3 Verification of Action-Specific Corrective Measure Requirements. Identification of action-specific CMRs will be made easier by the new information gathered on technologies and configurations during the screening process. The CMRs previously identified will be refined by project staff with input from Ecology and EPA. Regulatory agency participation will provide project focus and direction and expedite the CMS.

In the process of refining corrective measure alternatives, additional data needs may be identified. An assessment will be made as to their value to the 200-BP-11 Operable Unit conceptual model or alternative evaluation criteria. Data needs may require that treatability studies be conducted.

5.2.2.4 Evaluation of Data Needs. Additional site characterization data needs may develop during the screening phase, which would necessitate treatability studies. The work would then focus on a more thorough explanation of the effects on operable unit conditions or the performance of the corrective measure technologies and process option of greatest interest. The probable effectiveness of performance will be evaluated using sensitivity analysis. The DQOs will be refined or developed as needed for any treatability studies.

5.2.3 Corrective Measure Alternatives Analysis

The detailed analysis of alternatives will follow the development and screening of alternatives and precede the actual selection of a corrective measure. The results of the detailed analysis will provide the basis for identifying a preferred alternative and preparing the proposed CMP. The detailed analysis of alternatives will consist of the following components:

- Further definition of each alternative, if appropriate, with respect to the volumes or areas of contaminated media to be addressed, the technologies to be used, and any performance requirements associated with those technologies

- An assessment and a summary of each alternative against the evaluation criteria specified in EPA's interim final RI/FS (RFI/CMS) guidance document (EPA 1988a)

- A comparative analysis among the alternatives to assess the corrective measure.

A brief summary of the detailed analysis process can be found in EPA's interim final RI/FS (RFI/CMS) guidance document (EPA 1988a).

5.2.3.1 Definition of Corrective Measures Alternatives. The alternatives that remain after initial screening must be defined in detail prior to the detailed analysis. During the detailed analysis, each alternative will be reviewed to determine whether additional definition is required to apply the evaluation criteria consistently and to develop order-of-magnitude cost estimates (-30% to +50%), as guided by the *Remedial Action Costing Procedures Manual*, EPA-600/8-81/049 (EPA 1981). Information developed to further define alternatives at this stage may include preliminary design calculations; process flow diagrams; sizing of key process components; preliminary layouts; and a discussion of limitations, assumptions, and uncertainties concerning each alternative. Information collected from treatability investigations, if conducted, will also be used to further define applicable alternatives.

5.2.3.2 Detailed Analysis of Alternatives. A detailed analysis will be conducted on the limited number of alternatives that represent viable dangerous waste management approaches. The detailed analysis will consist of an assessment of individual alternatives against the nine evaluation criteria listed by the EPA (1988a) and discussed in the subsections below. A comparative analysis will be performed and will focus on the relative performance of each alternative against the criteria. This will result in a summary of the tradeoffs among alternatives.

5.2.3.2.1 Overall Protection of Human Health and the Environment. Alternatives will be assessed as to whether they can adequately protect human health and the environment by eliminating, reducing, or controlling risks.

5.2.3.2.2 Compliance with Corrective Measure Requirements. Alternatives will be assessed as to whether they attain CMRs of federal and Washington State environmental and public health laws or provide grounds for invoking one of the waivers under the proposed 40 CFR 300.430(f)(l)(ii)(c). Chemical-, location-, and action-specific CMRs will be evaluated.

5.2.3.2.3 Long-Term Effectiveness Analysis. Alternatives will be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful. Factors will include the following:

- Magnitude of total residual risk remaining following implementation of a remedial alternative

- The type, degree, and adequacy of long-term management required. This includes engineering controls, institutional controls, monitoring, and operation and maintenance

- Long-term reliability of controls including uncertainties associated with land disposal of untreated hazardous waste and treatment residuals

- The potential need for replacement of the corrective measure, e.g., barrier replacement.

5.2.3.2.4 Analysis of Reduction in Waste Toxicity, Mobility, and Volume. The degree to which alternatives employ treatment that reduces toxicity, mobility, or volume will be assessed. Factors that will be considered include the following:

- Treatment processes the alternatives employ and materials they will treat

- Amount of hazardous waste that will be destroyed or treated

- The degree that the toxicity, mobility, or volume of contamination will be expected to decrease

- The degree to which the treatment is irreversible

- Residuals that will remain following treatment

- The degree to which treatment reduces inherent hazards posed by principal threats at the site.

5.2.3.2.5 Short-Term Effectiveness Analysis. Short-term effectiveness of alternatives will be assessed considering the following:

- Short-term risks that might be posed to the community during implementation

- Potential impacts to workers during corrective measure and the effectiveness and reliability of protective measures

- Potential environmental impacts encountered during the corrective measure and the effectiveness and reliability of mitigative measures during implementation

- The time until protection is achieved.

5.2.3.2.6 Implementability Analysis. The ease or difficulty of implementing the alternatives will be assessed by considering the following:

- Degree of difficulty or uncertainty that is associated with construction and operation of the technology

- Expected operational reliability of the technologies the alternatives use and the ability to undertake additional action if required

- Ability and time required to obtain necessary approvals and permits from the agencies

- Available capacity and location that is needed for treatment, storage, and disposal services

- Availability of equipment and specialists that are needed

- Provisions ensuring necessary additional resources

- Timing of the availability of prospective technologies that may be under construction.

5.2.3.2.7 Cost Analysis. Capital, operation, and maintenance costs will be assessed. These will be accumulated and compared using a net present-value technique. The costs will be developed with an accuracy of -30% to +50%. Bench-scale or pilot-scale treatability studies may be a source of cost information. Accurate cost information will be necessary for the selection of the preferred alternative.

5.2.3.2.8 Analysis of Regulator Acceptance. Ecology, as lead agency, and EPA concerns will be assessed. The areas of concern are usually with the proposed use of waivers for the selected alternative.

5.2.3.2.9 Analysis of Community Acceptance. Community attitudes toward the alternatives will be assessed. A complete assessment is not likely to be possible until comments have been received on the proposed action. One of the functions of the Community Relations Plan will be to involve the community in the process and keep them informed throughout.

5.2.3.3 Comparison of Corrective Measure Alternatives. Once the alternatives have been individually assessed against the nine criteria provided in the National Contingency Plan, a comparative analysis will be conducted to evaluate each alternative in relation to each evaluation criterion. The key tradeoffs or concerns among alternatives will generally be based on the evaluations of short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume; implementability; and cost. Overall protection and compliance with CMRs serve as a threshold determination in that they either will or will not be met.

The comparative analysis will include a narrative discussion describing the strengths and weaknesses of the alternatives relative to one another with respect to each criterion. The potential advantages in cost or performance of innovative technologies and the degree of uncertainty in their expected performance will also be discussed. The differences between all of the alternatives will be summarized in matrix form to facilitate direct comparisons. The information obtained by analyzing the alternatives individually against the nine criteria in Section 5.2.3.2 will be the basis for the matrix.

5.2.4 Corrective Measures Study Report

The results of the initial development, screening, and analysis of alternatives will be combined into the CMS report and provided in Volume 3 of this document. The report will list the procedures for defining and evaluating the alternatives.

5.2.4.1 Report Preparation. The report will document the results of the identification and development of alternatives. Examples of the types of information to be included in the report are the following:

- New knowledge pertaining to Volumes 1 and 2 of this document including operable unit background with available project scoping information, and the nature and extent of contamination and contaminant fate and transport assessed from LFI data

- Confirmation of the operable unit environmental media of concern, including the rationale for continued inclusion in the CMS

- Identification of the CMOs for each environmental medium of concern

- Identification of the general response actions for each environmental medium of concern

- Identification of potential remediation technology types for each medium-specific general response action category

- Documentation of the assembly of general response actions, process options, and technologies into a range of corrective measures

- Identification of action-specific CMRs potentially pertinent to each alternative.

The following types of information pertinent to the screening phase will also be included:

- Definition of each alternative, including extent of remediation, area or volume of contaminated media, energy and area/space requirements of major technologies, process parameters, cleanup time frames, transportation distances, volume of remediation-derived waste and special considerations

- Screening evaluation summaries and comparisons between each alternative process

- Documentation of the screening process for determination of technical implementability of the technology

- Identification of potential technological process options for each technology type retained after screening

- Documentation of the process option evaluations and the selection of representative process options for each technology type.

The analysis of individual alternatives against the nine criteria (Section 5.2.3.2) will be presented as a narrative discussion accompanied by a summary matrix. The alternatives discussion will include data on technology components, quantity of hazardous materials handled, time required for implementation, process sizing, implementation requirements, and assumptions. The key CMRs for each alternative will also be incorporated into those discussions. The discussion will focus on how, and to what extent, the various factors within each of the criteria are addressed. A summary matrix will highlight the assessment of each alternative with respect to each of the criteria.

Table 5-1. Relationship Between Tasks and Field Activities.

Field Sampling Plan Tasks	Source Characterization (Task 2)	Geologic Investigation (Task 3)	Surface Water Sediment Investigation (Task 4)	Vadose Zone Investigation (Task 5)	Air Investigation (Task 6)
Primary Field Activities					
Surface Radiological Surveys	X	--	--	--	--
Surface Geophysics Surveys	X	--	--	--	--
Subsurface Geophysics	X	X	--	X	--
Boreholes	X	X	--	X	--
Test Pits	X	X	--	X	--
Augers	X	X	--	X	--
Surface Soil Sampling	X	--	--	--	--
Surface Water Sediment Sampling	X	--	X	--	--
Source Sampling	X	--	--	--	--
Perched Water Sampling	--	--	--	X	--
Air Monitoring	--	--	--	--	X
Pipeline Integrity Assessment	X	--	--	--	--
Supporting Field Activities					
Geodesic Surveys	X	X	X	X	X
Sample Designation and Handling	X	X	X	X	X
Decontamination	X	X	X	X	X
Waste Disposal	X	X	X	X	X

Table 5-2. Field Activities Associated with Source Characterization (Task 2). (sheet 1 of 3)

Location	Data Compilation and Review (Subtask 2a)	Field Activities (Subtask 2b)					
		Surface Radiological Surveys (Section 5.1.4.2)	Surface Geophysics Surveys (Section 5.1.4.3)	Boreholes (Section 5.1.4.4)		Test Pits and Augers (Section 5.1.4.5)	
Waste Management Unit(s)		Approximate Area	Types/ Approximate Area/Grid Spacing	Estimated Total Depth	Estimated Number of Chemical Samples	Estimated Total Depth	Estimated Number of Chemical Samples
216-B-3 Main Pond and Overflow Pond (Section 5.1.3.2.1)	Completed	141,700 m^2 (1,524,600 ft^2)	--	61 m (200 ft) 15 m (50 ft)	13 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8 8 8
216-B-3-3 Ditch (Section 5.1.3.2.1)	Completed	6,900 m^2 (74,000 ft^2)	--	15 m (50 ft)	10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8
216-B-3-1 and -3-2 Ditches, and Overflow Pond (Section 5.1.3.2.2)	Completed	121,950 m^2 (1,312,000 ft^2) This includes the area between the ditches	GPR/122,000 m^2/10 m (147,000 ft^2/33 ft)	15 m (50 ft) 15 m (50 ft)	10 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8
216-B-3A, -3B, and -3C Expansion Ponds (Section 5.1.3.2.3)	Completed	247,000 m^2 (2,657,200 ft^2)	--	--	--	9.2 m (30 ft)	8
216-E-28 Contingency Pond (Sction 5.1.3.2.4)	Completed	49,800 m^2 (1,306,800 ft^2)	--	--	--	--	--
Unplanned Releases UN-200-E-14 & -92 (Section 5.1.3.2.5)	Completed	-- --	--	--	--	--	--
Pipeline(s) (Section 5.1.3.3.3)	Completed	6,900 m^2 (74,000 ft^2)	GPR/6,900m^2/ 10 m (74,000 ft^2/ 33 ft^2)	--	--	9.2 m (30 ft) 9.2 m (30 ft)	3 3

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Table 5-2. Field Activities Associated with Source Characterization (Task 2). (sheet 2 of 3)

Location	Field Activities (Subtask 2b)					Laboratory Analysis (Subtask 2c)	Data Evaluation (Subtask 2d)
	Subsurface Geophysics (Section 5.3.2.5)		Surface Soil Sampling[a/] (Section 5.1.3.2)	Sediment Sampling[b/] (Section 5.1.3.2)	Pipeline Integrity Assessment (Section 5.1.3.3.3)	(Section 5.1.5)	(Section 5.1.6)
Waste Management Unit(s)	Wells	Estimated Depths	Estimated Number of Samples	Estimated Number of Samples			
216-B-3 Main Pond and Overflow Pond (Section 5.1.3.2.1)	new new 699-44-43B 699-44-42 699-43-42J 699-43-43	61 m (200 ft) 15 m (50 ft) 49 m (162 ft) 48 m (156 ft) 49 m (160 ft) 49 m (161 ft)	2	7	--	68 soil (COC and modified Appendix IX)	Yes
216-B-3-3 Ditch (Section 5.1.3.2.1)	new 699-43-45	15 m (50 ft) 70 m (192 ft)	--	4	--	34 soil (COC and modified Appendix IX)	Yes
216-B-3-1 and 216-B-3-2 Ditches (Section 5.1.3.2.2)	new new	15 m (50 ft) 15 m (50 ft)	4	4	--	48 soil (COC)	Yes
216-B-3A, -3B, and -3C Expansion Ponds (Section 5.1.3.2.3)	699-43-41F 699-42-40A 699-42-39B 699-40-39 699-40-40A 699-41-40	39 m (129 ft) 38 m (123 ft) 42 m (138 ft) 39 m (127 ft) 39 m (127 ft) 39 m (128 ft)	2	1	--	10 (Radionuclides)	Yes
216-E-28 Contingency Pond (Section 5.1.3.2.4)	--	--	--	--	--	--	No
Unplanned Releases UN-200-E-14 and -92 (Section 5.1.3.2.4)	--	--	--	--	--	--	No

Table 5-2. Field Activities Associated with Source Characterization (Task 2). (sheet 3 of 3)

Location	Field Activities (Subtask 2b)					Laboratory Analysis (Subtask 2c)	Data Evaluation (Subtask 2d)
	Subsurface Geophysics (Section 5.3.2.5)		Surface Soil Sampling[a] (Section 5.1.3.2)	Sediment Sampling[b] (Section 5.1.3.2)	Pipeline Integrity Assessment (Section 5.1.3.3.3)	(Section 5.1.5)	(Section 5.1.6)
Pipeline(s) (Section 5.1.3.3.3)	--	--	--	--	About 1,000 m of camera and surface radiation survey (inside pipe)	--	Yes

[a]Surface samples are not planned in the operable unit, but may be taken if surface radiation surveys indicate elevated radioactivity.
[b]Sediment samples will be taken during borehole, test pit, and auger sampling.
COC = contaminants of concern
GPR = ground-penetrating radar

Table 5-3. Activities Associated with Geological Investigations (Task 3).

Location	Data Compilation and Review (Subtask 3a)	Field Activities (Subtask 3b)						Laboratory Analysis (Subtask 3c)	Data Evaluation (Subtask 3d)
		Boreholes (Section 5.1.3.2)		Test Pits and Augers (Section 5.1.3.2)		Subsurface Geophysics (Section 5.1.4.6)		Number/type of Physical Analysis[b] (Section 5.1.5.2)	
Waste Management Unit(s)		Estimated Depth	Estimated number of Physical Samples	Estimated Depth	Estimated Number of Physical Samples	Wells	Estimated Depth		
216-B-3 Main Pond and Overflow Pond (Sec. 5.1.3.2.1)	Completed	61 m (200 ft) 15 m (50 ft)	13 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8 8 8	new new 699-44-43B 699-44-42 699-43-42J 699-43-43	61.0 m (200 ft) 15.2 m (50 ft) 49.4 m (162 ft) 47.5 m (156 ft) 48.8 m (160 ft) 49.1 m (161 ft)	36-Type A 6-Type B	Yes
216-B-3-3 Ditch (Sec. 5.1.3.2.1)	Completed	15 m (50 ft)	10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	-- -- --	new 699-43-45	15.2 m (50 ft) 58.5 m (192 ft)	34-Type A 3-Type B	Yes
216-B-3-1 and -3-2 Ditches (Sec. 5.1.3.2.3)	Completed	15 m (50 ft) 15 m (50 ft)	10 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	-- -- --	new new	15.2 m (50 ft) 15.2 m (50 ft)	44-Type A 3-Type B	Yes
216-B-3A, -3B, and -3C Expansion Ponds (Sec. 5.1.3.2.3)	Completed	--	--	9.2 m (30 ft)	8	699-43-41F 699-42-40A 699-42-39B 699-40-39 699-40-40A 699-41-40	39.3 m (129 ft) 37.5 m (123 ft) 42.1 m (138 ft) 38.7 m (127 ft) 38.7 m (127 ft) 39.0 m (128 ft)	8-Type A 2-Type B	Yes
216-E-28 Contingency Pond (Sec. 5.1.3.2.4)	Completed	--	--	--	--	--	--	--	Yes
Unplanned Releases UN-200-E-14 and -92 (Sec. 5.1.3.2.5)	Completed	--	--	--	--	--	--	--	Yes

[a]These activities are related to other tasks as well (see Table 5-1).
[b]See Section 5.1.5.2 for descriptions of Type A and Type B physical samples.

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Table 5-4. Activities Associated with Vadoze Zone Investigations (Task 5).[a] (sheet 1 of 2)

Location	Data Compilation and Review (Subtask 5a)	Field Activities (Subtask 5b)					
		Boreholes (Section 5.1.3.2)[a/]		Test Pits and Augers (Section 5.1.3.2)[a/]		Subsurface Geophysics (Section 5.1.4.6)[a/]	
Waste Management Units		Estimated Depth	Estimated number of Chemical Samples	Estimated Depth	Estimated number of Chemical Samples	Wells	Estimated Depth
216-B-3 Main Pond and Overflow Pond (Section 5.1.3.2.1)	Completed	61.0 m (200 ft) 15.2 m (50 ft)	13 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8 8 8	new new 699-44-43B 699-44-42 699-43-42J 699-43-43	61.0 m (200 ft) 15.2 m (50 ft) 49.4 m (162 ft) 47.5 m (156 ft) 48.8 m (160 ft) 49.1 m (161 ft)
216-B-3-3 Ditch (Section 5.1.3.2.1)	Completed	15.2 m (50 ft)	10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8	new 699-43-45	15.2 m (50 ft) 58.5 m (190 ft)
216-B-3-1 and 216-B-3-2 Ditches (Section 5.1.3.2.2)	Completed	15.2 m (50 ft) 15.2 m (50 ft)	10 10	9.2 m (30 ft) 9.2 m (30 ft) 9.2 m (30 ft)	8 8 8	new new	15.2 m (50 ft) 15.2 m (50 ft)
216-B-3A, -3B, and -3C Expansion Ponds (Section 5.1.3.2.3)	Completed	--	--	9.2 m (30 ft)	8	699-43-41F 699-42-40A 699-42-39B 699-40-39 699-40-40A 699-41-40	39.3 m (129 ft) 37.5 m (123 ft) 42.1 m (138 ft) 38.7 m (127 ft) 38.7 m (127 ft) 39.0 m (128 ft)
216-E-28 Contingency Pond (Section 5.1.3.2.4)	Completed	--	--	--	--	--	--
Unplanned Releases UN-200-E-14 and -92 (Section 5.1.3.2.5)	Completed	--	--	--	--	--	--

Table 5-4. Activities Associated with Vadoze Zone Investigations (Task 5).[a] (sheet 2 of 2)

Location	Field Activities (Subtask 5b)	Laboratory Analysis (Subtask 5c)		Data Evaluation (Subtask 5d)
	Potential Perched Water Sampling (Section 5.1.3.3)	(Section 5.1.5)		
Waste Management Units	Wells	Estimated Number of Physical Analyses[b]	Estimated Number of Chemical Analyses[c]	
216-B-3 Main Pond Overflow Pond (Section 5.1.3.2.1)	new new	63 Type A 6 Type B	65 soil (COC and modified Appendix IX)	Yes
216-B-3-3 Ditch (Section 5.1.3.2.1)	new	34 Type A 3 Type B	34 soil (COC and modified Appendix IX)	Yes
216-B-3-1 and 216-B-3-2 Ditches (Section 5.1.3.2.2)	new new	44 Type A 3 Type B	48 soil (COC)	Yes
216-B-3A, -3B, and -3C Expansion Ponds (Section 5.1.3.2.3)	--	8 Type A 2 Type B	10 (Radionuclides)	Yes
216-E-28 Contingency Pond (Section 5.1.3.2.4)	--	--	--	Yes
Unplanned Releases UN-200-E-14 and -92 (Section 5.1.3.2.5)	--	--	--	Yes

a/ These activities are related to other tasks as well (see Table 5-1).
b/ See Section 5.1.5.2 for descriptions of Type A and Type B physical samples.
c/ Additional chemical analyses will be required if perched water is encountered.
COC = contaminants of concern

Table 5-5. Activities Associated with Air Investigations (Task 6).

Air Samplers	Data Compilation and Review (Subtask 6a)	Field Activities (Subtask 6b) Air Sampling (Section 5.1.3.3) Estimated Number of Samples	Laboratory Analysis (Section 5.1.4.10) (Subtask 6c) Number/Type of Chemical Analyses	Data Evaluation (Subtask 6d)
N-158 N-991[a] N-992[a] N-977 (See Plate 1 for locations)	Completed	Quarterly during field activities	Five samples each quarter for Co-90, Sr-137, Pu-238, Pu-239, Pu-240, U, gross beta, and gross alpha	Yes
All locations where borings or test pits are planned	Completed	Daily during field activities	Gross beta, gross alpha, and portable volatile organic analyzer	Yes

[a] These air samples were deactivated in 1992, but can be easily reactivated by request.

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Table 5-6. Summary of Site-Specific Field Activities for Each Waste Management Unit and Unplanned Release.

Waste Management Unit	Primary Field Activities										Supporting Field Activities			
	Surface Radiological Surveys	Surface Geophysics Surveys	Boreholes	Test Pits[a]	Augers[a]	Subsurface Geophysics	Surface Soil Sampling[b]	Surface Water Sediment Sampling[c]	Perched Water Sampling[d]	Air Monitoring[e]	Geodetic Surveys	Sample Designation & Handling	Decontamination	Investigation Derived Waste Disposal
216-B-3 Main Pond and Overflow Pond	X	--	2	1	4	X	--	--	X	X	X	X	X	X
216-B-3-1 Ditch	X	X	2[f]	2	--	X	--	--	--	X	X	X	X	X
216-B-3-2 Ditch	X	X	--	1	--	--	--	--	--	X	X	X	X	X
216-B-3-3 Ditch	X	--	1[g]	--	3	X	--	--	--	X	X	X	X	X
216-B-3A Pond	X	--	--	--	1	--	--	--	--	X	X	X	X	X
216-B-3B Pond	X	--	--	--	--	--	--	--	--	--	--	--	--	--
216-B-3C Pond	X	--	--	--	--	--	--	--	--	--	--	--	--	--
216-E-28 Contingency Pond	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unplanned Release UN-200-E-14	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Unplanned Release UN-200-E-92	--	--	--	--	--	--	--	--	--	--	--	--	--	--

[a] Test pits and augers may be substituted for each other.
[b] Surface samples are not planned but may be taken depending on surface radiation.
[c] Surface water sediments were covered during stabilization activities, but will be taken during borehole, test pit, and auger sampling activities.
[d] Perched water sampling is assumed for only the groundwater well in the 216-B-3 Main Pond.
[e] Air monitoring will be at permanent air monitoring stations and during field activities.
[f] One borehole allocated to the 216-B-3-1 Ditch is located at the headwall of the 216-B-3-1, -3-2, and -3-3 Ditches.
[g] The borehole allocated to the 216-B-3-3 Ditch is located at the confluence of the 216-B-3-2 and -3-3 Ditches.

Table 5-7. Analytical Methods for Target Analytes. (sheet 1 of 4)

Analyte[a]	Analytical technique/method[b]	Practical quantitation limits (nonrad) or minimum detection limits (rad)[c]	Comments
METALS			
Arsenic	GFAA/7060	0.3	
Barium	ICP/6010	1	
Beryllium	ICP/6010	1	
Bismuth	ICP/6010	TBD	
Boron	ICP/6010	10	
Cadmium	ICP/6010	2	
Chromium-VI	ICP/6010	2	
Copper	ICP/6010	2	
Iron	ICP/6010	10	
Lead	ICP/6010 (or 7421)	10 (or 0.3)	
Manganese	ICP/6010	1	
Mercury	AA/7471	0.1	
Nickel	ICP/6010	4	
Potassium	ICP/6010	500	
Selenium	GFAA/6010 (or 7740)	25 (or 0.3)	
Silver	ICP/6010	20	
Tin	ICP/7870	50	
Vanadium	ICP/6010	2	
Zinc	ICP/6010	2	
IONS			
Acetate	Semi-VOA/8270	TBD	Analyzed as a TIC
Ammonia (ammonium)	IC/350.2	30	
Cyanide	Colorimetric/CLP Metals/9010	0.8	
Nitrate	IC/300 and 353	6	
Nitrite	IC/300 and 353	100	
Sulfate	IC/300	150	

Table 5-7. Analytical Methods for Target Analytes. (sheet 2 of 4)

Analyte[a]	Analytical technique/method[b]	Practical quantitation limits (nonrad) or minimum detection limits (rad)[c]	Comments
ORGANICS			
Acetone	VOA/8240	10	
Butanol, 1-	VOA/8240	TBD	Analyzed as a TIC
Butanone, 2- (MEK)	VOA/8240	10	
Carbon Tetrachloride	VOA/8240	5	
Chloroform	VOA/8240	5	
Ethyl Ether	VOA/8240	TBD	Analyzed as a TIC
Methylene Chloride	VOA/8240	5	
Trichloroethane, 1,1,1-	VOA/8240	5	
Trichloroethane, 1,1,2-	VOA/8240	5	
Toluene	VOA/8240	5	
Formaldehyde	Semi-VOA/8270	TBD	Analyzed as a TIC
Kerosene	Semi-VOA/8270	5,000	
PCBs	Semi-VOA/8080	33	
Tributyl Phosphate	Semi-VOA/8270	TBD	
Napthalene	Semi-VOA/8270	660	Special calibration required
RADIONUCLIDES			
Gross Alpha	Gas Proportional	--	
Gross Beta	Gas Proportional	--	
Cesium-137	Gamma Spectrometry/ D3649M	0.1	Measured by counting Ba-137m
Cobalt-60	Gamma Spectrometry/ D3649M	0.05	
Europium-152	Gamma Spectrometry/ D3649M	0.1	
Europium-154	Gamma Spectrometry/ D3649M	0.1	

Table 5-7. Analytical Methods for Target Analytes. (sheet 3 of 4)

Analyte[a]	Analytical technique/method[b]	Practical quantitation limits (nonrad) or minimum detection limits (rad)[c]	Comments
RADIONUCLIDES (cont.)			
Europium-155	Gamma Spectrometry/ D3649M	0.1	
Uranium-235 (Pa-231)	Gamma Spectrometry/ D3649M	1.0	Most samples measured by counting Pa-231
Americium-241	Alpha Spectrometry/Am-01	1.0	
Curium-244	Alpha Spectrometry/907.0M	1.0	May also use gamma spectrometry
Neptunium-237	Alpha Spectrometry/907.0M	1.0	
Plutonium-238	Alpha Spectrometry/Pu-02	1.0	
Plutonium-239/240	Alpha Spectrometry/Pu-02	1.0	
Plutonium-241	Alpha Spectrometry/Pu-02	15.0	
Thorium-228	Alpha Spectrometry/	TBD	
Thorium-230	Alpha Spectrometry/	1.0	
Thorium-232	Alpha Spectrometry/	1.0	
Uranium-233/234	Alpha Spectrometry/U	TBD	Most U-233/234 samples counted by measuring Pa-231m
Uranium-235	Alpha Spectrometry/U	1.0	Most U-235 samples measured by counting Pa-231
Uranium-236	Alpha Spectrometry/	TBD	
Uranium-238	Alpha Spectrometry/U	TBD	
Iodine-129	Beta Counting/902.0M	2.0	
Strontium-90 (Y-90)	Beta Counting/SR-02	1.0	
Technetium-99	Beta Counting/TC-01M	15.0	Measured by counting Y-90
Selenium-79	Beta Counting/	5.0	
Samarium-151	Beta Counting/	TBD	

Table 5-7. Analytical Methods for Target Analytes. (sheet 4 of 4)

Analyte[a]	Analytical technique/method[b]	Practical quantitation limits (nonrad) or minimum detection limits (rad)[c]	Comments
Additional Analytes for Water Samples Only			
Fluoride	IC/300	51	Water only
Carbon-14	Liquid Scintillation/C-01	50	Water only
Tritium (H-3)	Liquid Scintillation/906.0	400	Water only

GFAA = Graphite Furnace Atomic Adsorption
ICP = Inductively Coupled Plasma
AA = Atomic Adsorption
VOA = Volatile Organics Analysis
TIC = Tentatively Identified Compound
IC = Ion Chromatography
CLP = Contract Laboratory Program
TBD = To be determined
M = method modified to include extraction from the solid medium; extraction method is matrix and laboratory specific

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"Test Methods for Evaluating Solid Waste" (SW 846) Third Edition (EPA 1986)
"Methods for Chemical Analysis of Water and Waste" (EPA 1983b)
"Radionuclide Method for the Determination of Uranium in Soil and Air" (EPA 1980b)
"EML Procedures Manual" (DOE/EML 1990)
"Eastern Environmental Radiation Facility RadioChemistry Procedures Manual" (EPA 1984)
"High-Resolution Gamma-Ray Spectrometry of Water" (ASTM 1985)

[a]See Section 3.0 for discussion on progeny isotopes whose concentrations may be derived from known parent concentrations. Radionuclides related to U-238 include Th-230, Bi-210, Bi-214, Po-214, and Po-218. Radionuclides related to U-235 include Th-231, Tl-207, Pb-211, Pb-214, and Bi-211. Nb-93m is related to Zr-93. Pu-241 concentrations are inferred from Pu-238, Pu-239, and Pu-240. The radionuclides listed in parentheses under the analyte column are measured as part of the analysis of the adjacent radionuclide.

[b]These analytical methods should be considered examples of possible analytical techniques to use. Individual laboratories may have other techniques developed for some analytes. Analytical priorities are discussed in Section 5.1.5

[c]Units for metals are mg/kg (ppm), μg/L for ions, μg/kg (ppb) for organics, and pCi/g for radionuclides

[d]The uranium analyses will be conducted periodically to confirm the uranium concentrations calculated from the Pa-234m or Pa-231 analyses. Two samples from each boring and one sample from each test pit/auger will undergo this confirmatory analysis. No uranium analyses will be done on surface soil or sediment samples.

[e]Analytes that will be studied by beta counting are listed in the order that they should be analyzed (e.g., the Sr-90 analysis should be made first, followed by the Tc-99 analysis).

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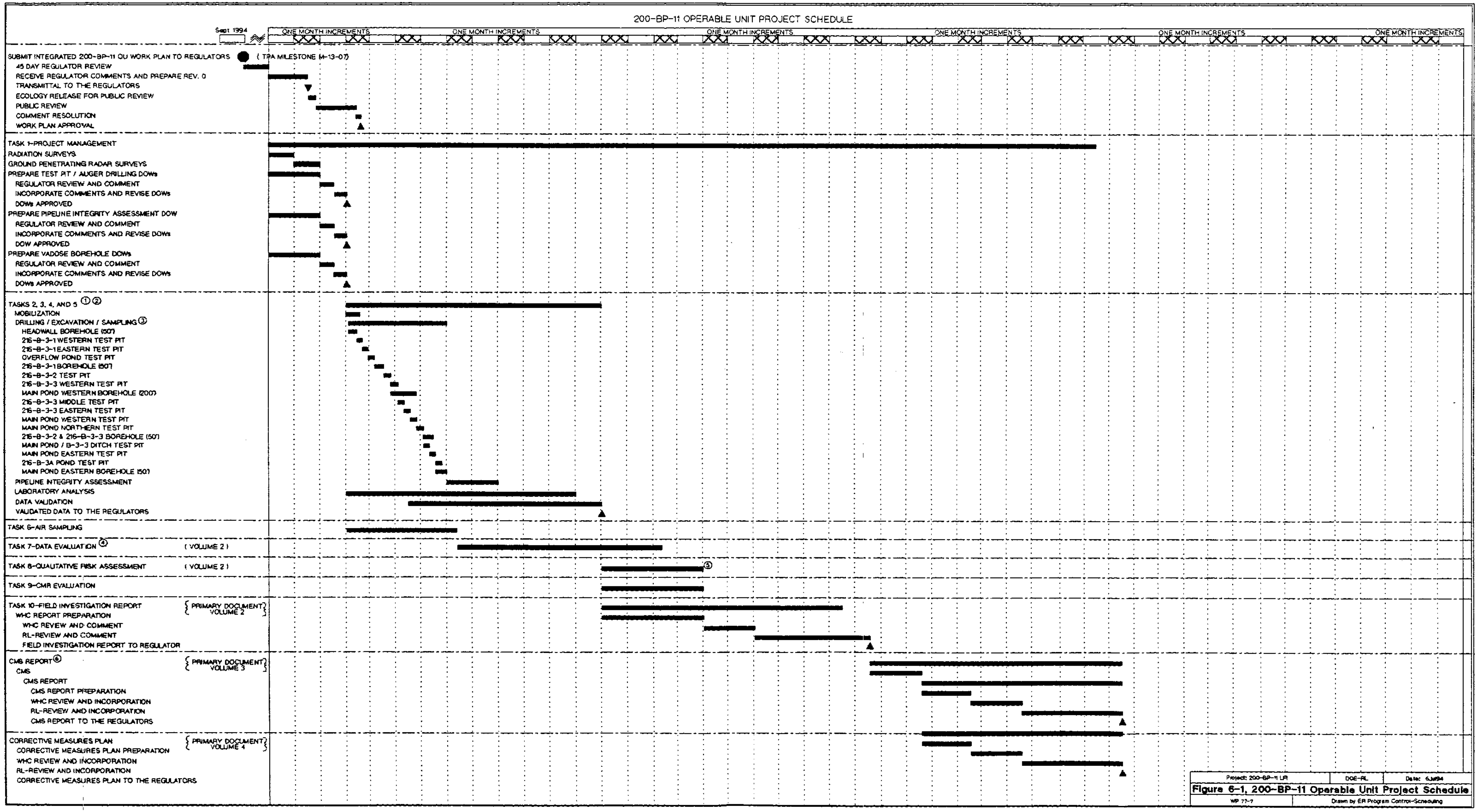
6.0 PROJECT SCHEDULE

The schedule for the field investigation activities described in Chapter 5.0 is shown in Figure 6-1. Additionally, as discussed in Section 1.1.2, the schedule shows completion dates and review cycles for Volumes 2, 3, and 4 of this work/closure plan. Volume 5, the corrective measures design report, is not shown on the schedule because it is not part of a closure/postclosure plan. This schedule is the baseline that will be used to measure progress in implementing this work/closure plan. It includes interim milestones to track and help ensure progress of the various tasks. A formal change control process has been established in the Tri-Party Agreement Action Plan, and will be used, if necessary, to modify milestones shown in this schedule.



① TASK 2: SOURCE CHARACTERIZATION; TASK 3: GEOLOGIC INVESTIGATION; TASK 4: POND / DITCH BOTTOM INVESTIGATION; TASK 5: VADOSE ZONE INVESTIGATION

② NON-INTRUSIVE ACTIVITES (i.e. SURFACE RADIATION SURVEYS, R.L.S. LOGGING IN EXISTING WELLS, SURFACE GEOPHYSICS, AND SURFACE SAMPLING) WILL COMMENCE PRIOR TO THE APPROVAL OF THE DOW's

③ ASSUMES ADDITIONAL SAMPLING WILL NOT BE REQUIRED

④ DOES NOT INCLUDE CYCLE FOR ADDITIONAL CHARACTERIZATION BASED ON DATA EVALUATION

⑤ ASSUMES CONTRACTOR DRAFT WILL BE SUPPLIED TO RL AND THE REGULATORS CONCURRENTLY

⑥ ASSUMES NO TREATABILITY TESTS

Figure 6-1. 200-BP-11 Operable Unit Project Schedule.

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7.0 REFERENCES

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APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

ACRONYMS

ASTM	American Society for Testing and Materials
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
DOE	U.S. Department of Energy
DOE-RL	U.S. Department of Energy, Richland Operations Office
DQO	data quality objective
EII	Environmental Investigations Instruction
EPA	U.S. Environmental Protection Agency
GC	gas chromatography
HEIS	Hanford Environmental Information System
IMO	Information Management Overview
MRP	Management Requirement and Procedures
QA	quality assurance
QAPI	Quality Assurance Program Index
QAPjP	Quality Assurance Project Plan
QI	Quality Instruction
QR	Quality Requirement
RCRA	*Resource Conservation and Recovery Act*
SAF	sample authorization form
VOA	volatile organics analysis
WHC	Westinghouse Hanford Company

GLOSSARY

Accuracy: Accuracy may be interpreted as the measure of the bias in a system. The factors that influence the accuracy of the data include sample procedures, field conditions, sample preservation, sample matrix, instrument calibration, and analysis technique. Sampling accuracy is normally assessed through the evaluation of matrix-spiked samples and reference samples (see glossary entry).

Audit: For the purposes of environmental investigations, audits are considered to be systematic checks to verify the quality of operation of one or more elements of the total measurement system. In this sense, audits may be of two types: (1) performance audits, in which quantitative data are independently obtained for comparison with data routinely obtained in a measurement system, or (2) system audits, involving a qualitative onsite evaluation of laboratories or other organizational elements of the measurement system for compliance with established quality assurance program and procedure requirements. For environmental investigations at the Hanford Site, performance audit requirements are fulfilled by periodic submittal of blind samples to the primary laboratory, or the analysis of split samples by an independent laboratory. System audit requirements are implemented through the use of standard surveillance procedures.

Bias: Bias represents a systematic error that contributes to the difference between a population mean of a set of measurements and an accepted reference or true value.

Blind Sample: A blind sample refers to any type of sample routed to the primary laboratory for performance audit purposes, relative to a particular sample matrix and analytical method. Blind samples are not specifically identified as such to the laboratory. They may be made from traceable standards, or may consist of sample material spiked with a known concentration of a known compound. See the glossary entry for Audit.

Comparability: For the purposes of environmental investigations, comparability is an expression of the relative confidence with which one data set may be compared with another.

Completeness: For the purposes of environmental investigations, completeness may be interpreted as a measure of the amount of valid data obtained compared to the total data expected under correct normal conditions.

Deviation: For the purposes of environmental investigations, deviation refers to an approved departure from established criteria that may be required as a result of unforeseen field situations or that may be required to correct ambiguities in procedures that may arise in practical applications.

Equipment Blanks: Equipment blanks consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. They are used to verify the adequacy of sampling equipment decontamination procedures, and are normally collected at the same frequency as field duplicate samples.

Field Blanks: Field blanks for water analyses consist of pure deionized distilled water, transferred to a sample container at the site and preserved with the reagent specified for the analyses of interest. They are used to check for possible contamination originating with the reagent or the sampling environment, and are normally collected at the same frequency as field duplicate samples.

Field Duplicate Sample: Field duplicate samples are samples retrieved from the same sampling location using the same equipment and sampling technique, placed in separate, identically prepared and preserved containers, and analyzed independently. Field duplicate samples are generally used to verify the repeatability or reproducibility of analytical data, and are normally analyzed with each analytical batch or every 20 samples, whichever is greater.

Matrix-Spiked Samples: Matrix-spiked samples are a type of laboratory quality control sample. They are prepared by splitting a sample received from the field into two homogenous aliquots (i.e., replicate samples) and adding a known quantity of a representative analyte of interest to one aliquot in order to calculate the percentage of recovery of that analyte.

Nonconformance: A nonconformance is a deficiency in the characteristic, documentation, or procedure that renders the quality of material, equipment, services, or activities unacceptable or indeterminate. When the deficiency is of a minor nature, does not effect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it shall not be categorized as a nonconformance. If the nature of the condition is such that it cannot be immediately and satisfactorily corrected, however, it shall be documented in compliance with approved procedures and brought to the attention of management for disposition and appropriate corrective action.

Precision: Precision is a measure of the repeatability or reproducibility of specific measurements under a given set of conditions. The relative percent difference is used to assess the precision of the sampling and analytical method. The relative percent difference is a quantitative measure of the variability. Specifically, precision is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is normally expressed in terms of standard deviation, but may also be expressed as the coefficient of variation (i.e., relative standard deviation) and range (i.e., maximum value minus minimum value). Precision is assessed by means of duplicate/replicate sample analysis.

Quality Assurance: For the purposes of environmental investigations, quality assurance refers to the total integrated quality planning, quality control, quality assessment, and corrective action activities that collectively ensure that the data from monitoring and analysis meet all end-user requirements and/or the intended end use of the data.

Quality Assurance Project Plan: The QAPjP is an orderly assembly of management policies, project objectives, methods, and procedures that defines how data of known quality will be produced for a particular project or investigation.

Quality Control: For the purposes of environmental investigations, quality control refers to the routine application of procedures and defined methods to the performance of sampling, measurement, and analytical processes.

Range: Range refers to the difference between the largest and smallest reported values in a sample, and is a statistic for describing the spread in a set of data.

Reference Samples: Reference samples are a type of laboratory quality control sample prepared from an independent, traceable standard at a concentration other than that used for analytical equipment calibration, but within the calibration range. Such reference samples are required for every analytical batch or every 20 samples, whichever is greater.

Replicate Sample: Replicate samples are two aliquots removed from the same sample container in the laboratory and analyzed independently.

Representativeness: For the purposes of environmental investigations, representativeness may be interpreted as the degree to which data accurately and precisely represent a characteristic of a population parameter, variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of a sampling program.

Split Sample: A split sample is produced through homogenizing a field sample and separating the sample material into two equal aliquots. Field split samples are usually routed to separate laboratories for independent analysis, generally for purposes of auditing the performance of the primary laboratory relative to a particular sample matrix and analytical method. See the glossary entry for Audit. In the laboratory, samples are generally split to create matrix-spiked samples (see the glossary entry).

VOA Trip Blanks: Volatile organics analysis (VOA) trip blanks are a type of field quality control sample, consisting of pure deionized distilled water in a clean, sealed sample container, accompanying each batch of containers shipped to the sampling site and returned unopened to the laboratory. Trip blanks are used to identify any possible contamination originating from container preparation methods, shipment, handling, storage or site conditions.

Validation: For the purposes of environmental investigations, validation refers to a systematic process of reviewing data against a set of criteria to provide assurance that the data are acceptable for their intended use. Validation methods may include review of verification activities, editing, screening, cross-checking, or technical review.

Verification: For the purposes of environmental investigations, verification refers to the process of determining whether procedures, processes, data, or documentation conform to specified requirements. Verification activities may include inspections, audits, surveillance, or technical review.

CONTENTS

CONTENTS (cont.)

TABLES:

1.0 PROJECT DESCRIPTION

1.1 PROJECT OBJECTIVE

The *200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan* and its supporting project plans have been developed to meet specific U.S. Environmental Protection Agency (EPA) guidelines for format and structure, within the overall quality assurance (QA) program structure mandated by the U.S. Department of Energy, Richland Operations Office (DOE-RL) for all activities at the Hanford Site. These DOE mandates include DOE Order 5700.6C, *Quality Assurance* (DOE 1991), and other QA guidance documents as applicable, e.g. the Hanford Analytical Services Quality Assurance Plan (DOE-RL 1994). The purpose of this Quality Assurance Project Plan (QAPjP) is to ensure the objectives described above and in Section 1.5 of this work/closure plan will be met. Data resulting from this investigation will be evaluated to determine the most feasible options for additional investigation, remediation, or closure.

1.2 BACKGROUND INFORMATION

The 200-BP-11 Source Operable Unit is located within the 200 Areas of the Hanford Site, shown in Figure 1-1 of the work/closure plan. The waste management units that will be studied during the 200-BP-11 Source Operable Unit field investigation are discussed in Chapter 1.0.

Detailed background information regarding the history and current use of the operable unit is provided in Chapter 2.0 of the work/closure plan.

1.3 QUALITY ASSURANCE PROJECT PLAN APPLICABILITY AND RELATIONSHIP TO THE BECHTEL HANFORD, INC. QUALITY ASSURANCE PROGRAM

This QAPjP applies specifically to the field activities and chemical laboratory analyses performed as part of the field investigation for the 200-BP-11 Source Operable Unit. It is prepared in compliance with the requirements of the Westinghouse Hanford Company (WHC) *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). This plan describes the means selected to implement the overall QA program requirements defined by the WHC *Quality Assurance Manual* (WHC 1988a), as applicable to the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) and *Resource Conservation and Recovery Act* (RCRA) facility investigation/corrective measures study environmental investigations. The QAPjP is subject to mandatory review and revision prior to use on any subsequent phases of the investigation. Distribution and revision control procedures applicable to the QAPjP and work/closure plan shall be in compliance with Quality Requirement (QR) 6.0, "Document Control" (WHC 1988a), and Quality Instruction (QI) 6.1, "Quality Assurance Document Control" (WHC 1988a). Interim changes to this QAPjP or the work/closure plan shall be documented, reviewed, and approved as required by Section 6 of Environmental Investigations Instruction (EII) 1.9, "Primary and Secondary Document Review" (WHC 1988b), and shall be documented in monthly unit managers' meeting minutes. The QAPjP distribution shall routinely include all review/approval personnel indicated on the title page of the document and all other individuals designated by the Bechtel Hanford, Inc. (BHI) technical lead for each investigation. All plans and procedures referenced in the QAPjP are available for regulatory review on request by the direction of the technical lead.

1.4 SCHEDULE OF ACTIVITIES

Five separate investigations will be conducted in the 200-BP-11 Source Operable Unit, including geological, surface water and sediment, groundwater, and ecological investigations, as well as an investigation made up of other miscellaneous tasks. More detailed discussions of individual tasks are contained in Chapter 5.0 of the work/closure plan. Procedures directly applicable to the tasks described here are discussed in Chapter 4.0 of the QAPjP.

The field-related tasks to be conducted are:

- Task 2: Source Characterization
- Task 3: Geologic Investigation
- Task 4: Surface Water/Sediment Investigation .
- Task 5: Vadose Zone Investigation
- Task 6: Air Investigation.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 TECHNICAL LEAD RESPONSIBILITIES

The Environmental Engineering Function of BHI has primary responsibilities for conducting this investigation. Organizational charts are included in the project management plan of the aggregate area management study report that define personnel assignments and individual BHI field team structures applicable to the tasks included in the investigations.

External participant contractors or subcontractors shall be evaluated and selected for certain portions of task activities at the direction of the technical lead in compliance with the following procedures in the WHC *Quality Assurance Manual* (WHC 1988a): QI 4.1, "Procurement Document Control;" QI 4.2, "External Services Control;" QR 7.0, "Control of Purchased Items and Services;" QI 7.1, "Procurement Planning and Proposal Evaluation;" and QI 7.2, "Supplier Evaluation." Major participant contractor and subcontractor resources are discussed in Chapter 7.0 of the work/closure plan. All contractor QA plans and field and laboratory procedures shall be approved by BHI prior to use and shall be made available for regulatory review at the direction of the BHI technical lead.

2.2 ANALYTICAL LABORATORIES

Regardless of the radiation levels observed during field screening, all samples shall be screened for total activity counts and isotopic identification in accordance with the *WHC Radiological Control Manual* (WHC 1993) prior to shipment to the analytical laboratory. Those samples with short holding times, such as volatile organic analyses (VOAs), will be given the highest priority during this screening to ensure that holding times are not exceeded.

Packaging and shipping requirements shall be selected on the basis of total activity values and the preservation requirements applicable to the parameters of interest, as described in EII 5.11, "Sample Packaging and Shipping" (WHC 1988b). All analyses shall be coordinated through BHI

Analytical Services and shall be performed in compliance with WHC-approved laboratory QA plans and analytical procedures; all analytical laboratories shall be subject to the surveillance controls described by QI 10.4, "Surveillance" (WHC 1988a). For subcontractors or participant contractors, applicable quality requirements shall be invoked as part of the approved procurement documentation or work order; see Section 4.2. Services of alternate qualified laboratories shall be procured for radioactive sample analysis if onsite laboratory capacity is not available, and/or for the performance of split sample analysis at the technical lead's discretion. If such an option is selected, the laboratory QA plan and applicable analytical procedures from the alternate laboratory shall be approved by BHI before their use, as noted in Section 4.2.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENTS

The rationale for establishing data quality objectives (DQOs) and data needs for this investigation is presented in Section 4.1 of the work/closure plan. Analytical procedures are discussed in Chapter 7.0 of the QAPjP and include both standard and nonstandard procedures. Standard EPA methods selected from *Test Methods for Evaluating Solid Waste* (EPA 1986) shall be used for analysis of metals and organics as shown in Table QAPjP-1. Standard EPA and U.S. Department of Energy (DOE) methods shall also be used for analysis of the radiological parameters. Analysis of the soil physical properties will require both standard American Society for Testing and Materials (ASTM) methods and nonstandard methods as described in Chapters 4.0 and 5.0 of the work/closure plan. Methods for soil analysis have been published by the American Society of Agronomy, and include *Methods of Soil Analysis: Part 1* (Klute 1986) and *Methods of Soil Analysis: Part 2 - Chemical and Microbiological Properties* (Page et al. 1982). These reference methods will form the basis of project-specific test procedures that shall be developed, reviewed, approved, and issued in compliance with QR 11.0, "Test Control" (WHC 1988a).

All of the analytical parameters selected for the soil and water sampling phase of this investigation are listed in Table QAPjP-1 and cross-referenced to analytical method requirements and maximum quantitation limit or detection limit values and maximum acceptable ranges for precision and accuracy in soil matrices. Where Practical Quantitation Limits are not defined for a particular parameter listed in Table QAPjP-1, Contractually Required Quantitation Limits are provided that represent maximum values that can be reliably achieved by analytical laboratories under normal conditions. Precision and accuracy values are provided for all chemical and radiological parameters that also represent maximum values that can be reliably achieved by analytical laboratories under normal conditions. The requirements of Table QAPjP-1 shall be considered a minimum performance standard and shall be incorporated into the agreements for services established with individual BHI, participant contractor, or subcontractor analytical laboratories.

Goals for data representativeness are addressed qualitatively by the specification of sampling depths and intervals in Section 4.2 of the work/closure plan. Sampling locations are specified in Chapter 5.0 or work orders issued to the subcontractors or participating contractors responsible for conducting sampling activities. Objectives for the completeness of this investigation shall require that contractually or procedurally established requirements for precision and accuracy be met for at least 90% of the total number of requested determinations. Failure to meet this criterion shall be documented and evaluated in the validation process described in Chapter 8.0; corrective action shall be taken as warranted, as described in Chapter 13.0. Approved analytical procedures shall require the use of the reporting techniques and units specified in the EPA reference methods in Table QAPjP-1 to facilitate the comparability of data sets in terms of precision and accuracy.

4.0 SAMPLING PROCEDURES

4.1 WHC PROCEDURES

The WHC procedures that will be used to support the work/closure plan have been selected from the quality assurance program index (QAPI) included in the WHC *Environmental Engineering, Technology and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Selected procedures include EIIs from the *Environmental Investigations and Site Characterization Manual* (WHC 1988b), and QRs and QIs from the *Quality Assurance Manual* (WHC 1988a). Procedure approval, revision, and distribution control requirements applicable to EIIs are addressed in EII 1.2, "Preparation and Revision of Environmental Investigation Instructions" (WHC 1988b); requirements applicable to QIs and QRs are addressed in QR 5.0, "Instructions, Procedures, and Drawings" (WHC 1988a). Other procedures applicable to the preparation, review, and revision of Analytical Services and other Hanford analytical laboratory procedures shall be defined in the various procedures and manuals identified in the *Environmental Engineering, Technology and Permitting Function Quality Assurance Program Plan* (WHC 1990a) under criteria 5.00 and 6.00. All procedures are available for regulatory review on request at the direction of the technical lead.

4.2 PARTICIPANT CONTRACTOR/SUBCONTRACTOR PROCEDURES

As previously noted in Section 2.1, participant contractor and/or subcontractor services shall be procured under the applicable requirements of QR 4.0, "Procurement Document Control," QR 7.0, "Control of Purchased Items and Services" (WHC 1988a), and other procedures as identified under criteria 4 and 7 of the QAPI included in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Submittal of procedures for BHI review and approval before use shall be included in the procurement document or work order, as applicable, when such services require procedural controls. Analytical laboratories shall be required to submit the current version of their internal QA program plans, and analytical procedures for review and acceptance by qualified personnel from the BHI Analytical Services, or other qualified personnel, as directed by the technical lead.

All reviewers shall be qualified under the requirements of EII 1.7, "Indoctrination, Training and Qualification" (WHC 1988b), or the *Management Requirements and Procedures Manual*, Management Requirement and Procedure (MRP) 4.2, "Employment Personnel and Placement" (WHC 1988d), as applicable. All participant contractor or subcontractor procedures, plans, and/or manuals shall be retained as project records in compliance with Section 9 of the *Document Control and Records Management Manual* (WHC 1990b).

4.3 PROCEDURE CHANGES

Should deviations from established EIIs be required to accommodate unforeseen field situations, they may be authorized by the field team leader in accordance with the requirements specified in EII 1.4, "Instruction Change Authorizations" (WHC 1988b). Documentation, review, and disposition of instruction change authorization forms shall be as defined by EII 1.4. Other types of procedure change requests shall be documented as required by QR 6.0, "Document Control" (WHC 1988a), or other procedures as identified under criterion 6 of the QAPI included in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). To deviate from established radiation monitoring procedures, a field change request shall be completed in accordance with the *WHC Radiological Control Manual* (WHC 1993) and approved by the Occupational Health and Safety manager assigned to this investigation.

4.4 SAMPLING PROCEDURES

4.4.1 Sample Acquisition

All soil and sludge sampling shall be performed in accordance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988b). Perched water sampling shall be performed in compliance with EII 5.8, "Groundwater Sampling" (WHC 1988b); soil-gas sampling shall be performed in compliance with EII 5.9, "Soil-Gas Sampling" (WHC 1988b). Surface water and other specialized types of sampling shall be in compliance with EIIs developed in accordance with EII 1.2, "Preparation and Revision of Environmental Investigations Instructions" (WHC 1988b), or BHI-approved participant contractor or subcontractor procedures. All drilling activities shall be in compliance with WHC-S-014, "Generic Specification for Groundwater Monitoring Wells" (Hodge 1990). All boreholes shall be logged in compliance with EII 9.1, "Geologic Logging" (WHC 1988b). Sampling procedure applicability to individual project tasks is shown in Table 5-2 of the work/closure plan. Sampling depths and intervals will be identified in site-specific descriptions of work prepared in compliance with EII 1.14, "Preparation of Descriptions of Work" (WHC 1988b). Sample locations will be detailed in the statements of work or work orders issued to the responsible subcontractors or participating contractors. Documentation requirements are contained within individual EIIs and the Information Management Overview (IMO).

Sample container types, preservation requirements, analyses, and special handling requirements are defined in EII 5.2, "Soil and Sediment Sampling" (WHC 1988b). Analytical Services may require the use of sample authorization forms (SAFs) to further define these requirements. Written instructions on these requirements shall be provided by a description of work prior to conducting sampling activities.

4.4.2 Radiological Testing

The BHI field sampling team leader and the assigned health physics technician shall be responsible for screening all samples collected to determine proper handling protocols, in compliance with the Radiation Work Permit established for the sampling site. At a minimum, all sampler assemblies shall be screened for alpha and beta gamma radiation with field instrumentation in compliance with descriptions of work written for specific activities. Sampler assemblies that do not exhibit radiation above background levels may be opened and sample materials extracted and placed in appropriate containers in compliance with EII 5.2, "Soil and Sediment Sampling" (WHC 1988b). Any samples exhibiting radiation levels during field screening that are above background will be handled per approved Radiation Work Permits.

4.4.3 Geologic and Geophysical Testing

Borehole logging shall be conducted concurrent with the drilling operations. A well sheet summary shall be completed for the entire length of the boring activity for each day. The summary sheet shall contain the geologic and construction information listed in EII 9.1, "Geologic Logging" (WHC 1988b).

4.5 OTHER INVESTIGATIVE AND SUPPORTING PROCEDURES

Procedures that will be required in this investigation are identified in the text of the work/closure plan and in Table QAPjP-2. Documentation requirements shall be addressed within individual procedures and/or the IMO as appropriate. Analytical procedures required for this investigation are listed in Table QAPjP-1. All computer software models developed for this investigation shall be documented and verified to comply with procedures identified under criterion 3 of the QAPI included in the program plan (WHC 1990a).

4.6 RECORDS

Records requirements for sample collection include (but are not limited to) field notebooks, chain-of-custody records, sample analysis request forms, geologic logs, scintillation logs, and other documents. All records shall be managed in compliance with EII 1.6, "Records Management" (WHC 1988b), and the *Document Control and Records Management Manual* (WHC 1990b).

5.0 SAMPLE CUSTODY

5.1 CHAIN-OF-CUSTODY PROCEDURES

All samples obtained during the course of this investigation shall be controlled as required by EII 5.1, "Chain of Custody" (WHC 1988b), from the point of origin to the analytical laboratory. Samples are to be prepared, packaged, and transported to the laboratory in accordance with EII 5.11, "Sample Packaging and Shipping" (WHC 1988b). Laboratory chain-of-custody procedures shall be reviewed and approved in compliance with the requirements of Section 4.1 of this QAPjP, and shall ensure the maintenance of sample integrity and identification throughout the analytical process. At the direction of the technical lead, requirements for the return of residual sample materials after completion of analysis shall be defined in accordance with procedures described in the procurement documentation to subcontractor or participant contractor laboratories. Chain-of-custody forms shall be initiated for returned residual samples as required by the approved procedures applicable within the laboratory. All analytical results shall be controlled as permanent project quality records as required by EII 14.1, "Analytical Laboratory Data Management" (WHC 1988b), and Section 9 of the *Document Control and Records Management Manual* (WHC 1990b).

6.0 CALIBRATION PROCEDURES

The procedural control for the use, handling, maintenance, and calibration of health and safety monitoring instruments used in RCRA and CERCLA investigations shall be done in accordance with EII 3.2, "Calibration and Control of Monitoring Instruments" (WHC 1988b). Calibration of all BHI measuring and test equipment, whether in existing inventory or procured for this investigation, shall be controlled as required by QR 12.0, "Control of Measuring and Test Equipment" (WHC 1988a), and other procedures as identified under criterion 12 of the QAPI included in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). The daily checks and calibration procedures for instruments used to measure radiological and chemical constituents in soil during drilling activities are provided in EII.3.4, "Field Screening" (WHC 1988b). The instruments used for geophysical borehole logging shall be calibrated and operated in accordance with EII 11.1, "Geophysical Logging" (WHC 1988b), and *Base Calibration of Pacific Northwest Laboratory's Gross Gamma Borehole Geophysical Logging System* (WHC 1992a). All calibration of analytical laboratory equipment shall be as defined by applicable standard analytical methods and are subject to BHI review and approval prior to use.

7.0 ANALYTICAL PROCEDURES

Analytical methods or procedures for each parameter identified in Table QAPjP-1 shall be selected or developed and approved before use to comply with appropriate WHC procedures and/or procurement control requirements. Table QAPjP-1 contains minimum requirements that shall be considered minimum performance standards that shall be incorporated into the agreements for services established with all analytical laboratories.

The final requirements for sample preservation, containers, and holding times for each of the analytes of interest will be specified in the SAF from Analytical Services. The preservation technique should be initiated immediately after the sample is extracted. Holding time is based on the maximum amount of time allowable, if proper preservation techniques are applied, to analyze the sample before the validity of the data could be considered suspect. All analytical procedures approved for use in this investigation shall require the use of standard units to facilitate the comparability of data sets in terms of precision and accuracy. All approved procedures shall be retained in the project quality records and shall be available for review on request.

Table QAPjP-1 listed various methods for the analysis of parameters listed. Standard EPA approved methods for evaluating solid waste (i.e., *Test Methods for Evaluating Solid Wastes* [EPA 1986]) will be used for analysis of the metals and organics. Geochemical and physical property testing will be conducted based on ASTM or other nationally recognized consensus methods. All test methods shall be documented by the laboratory and submitted for BHI approval prior to use. These tests shall be performed in accordance with QR 11.0, "Test Control" (WHC 1988a).

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 DATA REDUCTION AND DATA PACKAGE PREPARATION

All analytical laboratories shall be responsible for preparing a report summarizing the results of analysis and for preparing a detailed data package. The data package includes identifying samples, sampling and analysis dates, raw analytical data, reduced data, data outliers, reduction formulas, recovery percentages, quality control check data, equipment calibration data, supporting chromatogram or spectrograms, and documentation of any nonconformances affecting the measurement system in use during the analysis of the particular group of samples. Data reduction schemes shall be contained within individual laboratory analytical methods and/or QA manuals, submitted for BHI review and approval as discussed in Section 4.1. The completed data package shall be reviewed and approved by the analytical laboratory's QA manager (or field team leader for field screening type analysis) before its submittal to the BHI technical lead. Completed data packages shall be submitted to Analytical Services for tracking and data validation functions. All data packages shall be verified; the percentage of data packages requiring fill validation will be established based on the end use of the data. The requirements of this section shall be included in procurement documentation or work orders, as appropriate, to comply with the standard BHI procurement control procedures noted in Section 4.1.

8.2 VALIDATION

Validation of the completed data package will be performed by qualified BHI Analytical Services personnel or by a qualified independent contractor. Subcontracted validation responsibilities shall be defined in procurement documentation or work orders as appropriate. All validation shall be performed in compliance with the *Sample Management and Administration Manual* (WHC 1990c) Section 2.1 for inorganics analyses, Section 2.2 for organics analyses, and Sections 2.3 and 2.4 for radionuclide analysis. Data validation has been previously agreed to by the DOE-RL, Washington Department of Ecology, and EPA as documented in Appendix C as follows: All borehole samples will be validated and 20% of remaining data packages will be validated.

8.3 FINAL REVIEW AND RECORDS MANAGEMENT CONSIDERATIONS

All validation reports and supporting analytical data packages shall be subject to a final technical review by a qualified reviewer at the direction of the BHI technical lead, before their submittal to regulatory agencies or inclusion in reports or technical memoranda. All validation reports, data packages, and review comments shall be retained as permanent project quality records in compliance with the *Document Control and Records Management Manual* (WHC 1990b) requirements.

8.4 PROCESS FOR HANDLING UNACCEPTABLE OR SUSPECT DATA

The analytical data flow and data management process is described in detail in EII 14.1, "Analytical Laboratory Data Management" (WHC 1988b). Data errors or procedural discrepancies related to laboratory analytical processes shall prompt data requalification by the validator, requests for reanalysis, or other appropriate corrective action by the responsible laboratory as required by governing Analytical Services or approved subcontractor data validation procedures. If sample holding time requirements are compromised, insufficient sample material is available for reanalysis, or any other condition prevents compliance with governing analytical methods and data validation protocols, the situation shall be formally documented as a nonconformance in compliance with QR 15.0, "Control of Nonconforming Items" (WHC 1988a). Corrective action shall be in accordance with QR 16.0 (WHC 1988a) and WHC-CM-1-4 (WHC 1992b), and brought to the immediate attention of the BHI technical lead and QA coordinator for their appropriate action. If problems are observed with validated data, either as part of the data assessment process described in Chapter 12.0 of this QAPjP or if separately observed by the operable unit manager, the data shall be documented as a nonconformance and corrective action initiated as previously noted; if the data have been entered in the Hanford Environmental Information System (HEIS), the HEIS data custodian shall be immediately notified in order that the data may be flagged (in compliance with EII 14.1 and the *HEIS User's Manual* [WHC 1990d]) as suspect, pending resolution of the nonconformance and completion of all required corrective actions.

9.0 INTERNAL QUALITY CONTROL

General procedures used in the field and laboratory to maintain data quality include the following:

- Use of accepted sampling and analysis techniques
- Justification and documentation of any actions contrary to accepted or specified techniques
- Documentation of pre-field activities, such as container preparation and instrument calibration
- Documentation of post-field activities including sample shipment and receipt, equipment check-in, and debriefing
- Documentation of quality control data
- Documentation of field and laboratory activities
- Generation of quality control samples.

All analytical samples shall be subject to in-process quality control measures in both the field and laboratory. Internal quality control checks for reference method analysis shall be as specified by the current statement of work, work orders for sampling activities, or in applicable EIIs; the number of quality control samples are shown in Table QAPjP-4.

9.1 FIELD QUALITY CONTROL CHECKS

The number of field quality control samples specified in Table QAPjP-4 are based on the following minimum requirements. These requirements are adapted from *Test Methods for Evaluating Solid Waste* (EPA 1986), as modified by the proposed rule changes included in the *Federal Register*, 1989, Volume 54, No. 13, pp 3212-3228, and 1990, Volume 55, No. 27, pp 4440-4445.

- Field duplicate samples. For each shift of sampling activity under an individual sampling subtask, a minimum of 5% of the total collected samples shall be duplicated, or one duplicate shall be collected for every 20 samples, whichever is greater. Duplicate samples shall be retrieved from the same sampling location using the same equipment and sampling technique and shall be placed into two identically prepared and preserved containers. All field duplicates shall be analyzed independently to provide an indication of gross errors in sampling techniques.

- Split samples. Upon specific BHI or regulator request, and at the technical lead's direction, field or field duplicate samples may be split in the field and sent to an alternative laboratory as a performance audit of the primary laboratory. Frequency shall meet the minimum schedule requirements for audit procedures or the specific needs of the requesting organization.

- Blind samples. At the technical lead's discretion, blind reference samples may be introduced into any sampling round as a quality control check of the primary laboratory. Blind sample type shall be as directed by the technical lead; frequency shall meet the minimum schedule requirements for audit procedures.

- Field blanks. Field blanks shall consist of pure deionized distilled water, transferred into a sample container at the site and preserved with the reagent specified for the analytes of interest. Field blanks are used as a check on reagent and environmental contamination and shall be collected at the same frequency as field duplicate samples.

- Equipment rinsate blanks. Equipment blanks shall consist of pure deionized distilled water washed through decontaminated sampling equipment and placed in containers identical to those used for actual field samples. Equipment blanks are used to verify the adequacy of sampling equipment decontamination procedures and shall be collected at the same frequency as field duplicate samples where applicable.

- Volatile organic analysis trip blanks. The VOA trip blanks consist of pure deionized distilled water added to one clean sample container, accompanying each batch (cooler) of containers shipped to the sampling facility. Trip blanks shall be returned unopened to the laboratory and are prepared as a check on possible contamination originating from container preparation methods, shipment, handling, storage, or site conditions. The trip blank shall be analyzed for volatile organic compounds only, as shown on EPA's target compound list (EPA 1991). In compliance with standard BHI procurement procedures, requirements for trip blank preparation shall be included in procurement documents of work orders to the sample container supplier and/or preparer.

9.2 LABORATORY QUALITY CONTROL CHECKS

Laboratory quality control data are necessary to determine precision and accuracy of the analyses and to demonstrate the absence of interferences and contamination of glassware and reagents. Unless otherwise specified in BHI-approved analytical methods, internal quality control checks performed by analytical laboratories shall meet the following minimum requirements.

- Matrix-spike/matrix-spike duplicate samples. Matrix-spiked samples require the addition of a known quantity of a representative analyte of interest to the sample as a measure of recovery percentage and as a test of analytical precision. The spike shall be made in a replicate of a field duplicate sample. Replicate samples are separate aliquots removed from the same sample container in the laboratory. Spike compound selection, quantities, and concentrations shall be described in the analytical procedures submitted for BHI review and approval. One sample shall be spiked per analytical batch, or once every 20 samples, whichever is more frequent.

- Quality control reference samples. A quality control reference sample shall be prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples are required as an independent check on analytical technique and methodology and shall be run with every analytical batch, or every 20 samples, whichever is more frequent.

Other requirements specific to laboratory analytical equipment calibration are included in Chapter 6.0 of this QAPjP. For field screening gas chromatography (GC) analysis only, at least one duplicate sample per day or 1 duplicate per 20 samples, whichever is greater, shall be routed to a qualified laboratory as an overcheck on the proper use and functioning of field GC procedures and equipment. Duplicates shall be selected, whenever possible, from samples in which significant readings have been observed during field analysis. The minimum requirements of this section shall be invoked in procurement documents or work orders in compliance with standard WHC procedures as noted in Section 4.1.

10.0 PERFORMANCE AND SYSTEM AUDITS

Systems audits consist of the evaluation of the components of the measurement systems to determine their proper selection and use. Systems audit requirements will be implemented according to the procedures in QI 10.4, "Surveillance" (WHC 1988a), and other associated procedures as identified in the QAPI in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a).

After systems are operational and are generating data, performance audits will be conducted to ensure the accuracy of the total system or its individual parts. In a performance audit, known quantitative data are compared with data produced by the measurement system. Performance audits will be conducted in accordance with EII 1.12, "Performance Audits" (WHC 1988b).

Performance and systems audits will be performed regularly throughout the course of the activities addressed by the work plan; schedules shall be developed as required by their governing procedures. Additional surveillance may be scheduled as a consequence of corrective action requirements or may be performed upon request. All quality-affecting activities are subject to surveillance. All aspects of inter-operable unit activities may also be evaluated as part of routine QA program audits, pursuant to the requirements of the *Quality Assurance Manual* (WHC 1988a). Program audits shall be conducted in accordance with QR 18.0, "Audits" (WHC 1988a).

Any discrepancies observed during the evaluation of performance audit results or during system audit surveillance activities that cannot be immediately corrected to the satisfaction of the investigator shall be documented on a surveillance report and resolved in compliance with procedure QI 10.4, "Surveillance" (WHC 1988a).

11.0 PREVENTIVE MAINTENANCE

All measurement and testing equipment used in the field and laboratories that directly affect the quality of the field and analytical data shall be subject to preventive maintenance measures that ensure minimization of measurement system downtime and corresponding schedule delays. Laboratories shall be responsible for performing or managing the maintenance of their analytical equipment. Maintenance requirements, spare parts lists, and instructions shall be included in individual laboratory QA plans, subject to BHI review and approval as noted in Sections 2.1, 2.2, and 4.1 of this QAPjP. BHI field equipment shall be drawn from inventories subject to standard preventive maintenance and calibration procedures as noted under criterion 12 of the QAPI included in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Field procedures submitted for BHI approval by participant contractors or subcontractors shall contain provisions for preventive maintenance schedules and spare parts lists to ensure minimization of equipment downtime.

12.0 DATA MEASUREMENT ASSESSMENT PROCEDURES

As discussed in Chapter 5.0, various uncertainty may exist in the variability of physical and chemical parameters used in the data characterization. Various statistical and probabilistic techniques may be used in the process of data comparison and analysis. *Soil Sampling Quality Assurance User's Guide* (Barth and Mason 1984) provides statistical techniques necessary to numerically assess the statistical uncertainty considerations and quality control checks which shall be routinely assessed for all sampling data. *A Rationale for the Assessment of Errors in the Sampling of Soils* (Van Ee and Blume 1989) also provides equations for estimating uncertainty of data. The statistical methodologies and assumptions to be used in such evaluations shall be defined by written directions that are signed, dated and retained as project records in compliance with EII 1.6, "QA Record Processing" (WHC 1988b), and Chapter 9 of the *Document Control and Records Management Manual* (WHC 1990b).

13.0 CORRECTIVE ACTION

Corrective action requests required as a result of surveillance reports, nonconformance reports, or audit activity shall be documented and dispositioned as required by QR 16.0, "Corrective Action" (WHC 1988a). Other measurement systems procedure or plan corrections that may be required as a result of data assessment or routine review processes shall be resolved as required by governing procedures or shall be referred to the technical lead for resolution. Copies of all surveillance, nonconformance, audit, and corrective action documentation shall be placed with the project quality records on completion or closure.

13.1 EQUIPMENT OPERATING RANGES

Instruments or equipment found to be operating outside acceptable operating ranges or found to be in use after the expiration of the calibration period must be investigated in accordance with the procedures specified in Chapter 6.0.

13.2 DEVIATIONS FROM PROCEDURES

Unplanned deviations from procedural requirements, either technical or administrative, must be documented and called to the attention of the technical lead. The report of the deviation must identify the requirement deviated from, the cause of the deviation, whether any data were affected, and the corrective action necessary to remedy the immediate problem and to prevent recurrence. Records of unplanned deviations must be maintained in accordance with EII 1.2, "Preparation and Revision of Environmental Investigations Instructions" (WHC 1988b), and Section 9 of the *Document Control and Records Management Manual* (WHC 1990b). Planned deviations will be handled in accordance with EII 1.4, "Instruction Change Authorizations" (WHC 1988b).

13.3 NONCONFORMING MATERIALS

Materials that do not conform to specifications must be handled as required by QR 15.0, "Control of Nonconforming Items" (WHC 1988a), and other procedures as identified under criterion 15 of the QAPI included in the *Environmental Engineering, Technology, and Permitting Function Quality Assurance Program Plan* (WHC 1990a). Such nonconforming items must be segregated and tagged to identify their status pending disposition.

14.0 QUALITY ASSURANCE REPORTS

As previously stated in Chapters 10.0 and 13.0, project activities shall be regularly assessed by performance and system auditing and associated corrective action processes. Surveillance, nonconformance, audit, and corrective action documentation shall be routed to the project quality records on completion or closure of the activity. A report summarizing all audit and surveillance activity (see Sections 4.4 and 13.2), and any associated corrective actions, shall be prepared by the technical lead by the QA coordinator at the completion of the investigation. Such information will become an integral part of the final field investigation report prepared under Task 10 (see Chapter 5.0). The final report shall include an assessment of the overall adequacy of the total measurement system with regard to the DQOs of the investigation.

15.0 REFERENCES

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WHC, 1992a, *Base Calibration of Pacific Northwest Laboratory's Gross Gamma Borehole Geophysical Logging System,* WHC-EP-0276, Westinghouse Hanford Company, Richland, Washington.

WHC, 1992b, *Corrective Action Management Manual*, WHC-CM-1-4, Westinghouse Hanford Company, Richland, Washington.

WHC, 1993, *WHC Radiological Control Manual,* WHC-CM-1-6, Westinghouse Hanford Company, Richland, Washington.

Table QAPjP-1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the 200-BP-11 Source Operable Unit.

Analyte	Analytical Method	Target Quantitation Limit Soil[a]	Precision, Soil[b]	Accuracy, Soil[b]	Target Quantitation Limit Water[a]	Precision, Water[b]	Accuracy, Water[b]
Acetone	8240[c]	10 μg/kg	±20	75-125	TBD	±20	75-125
Butanol, 1-	8240[c][j]	TBD μg/kg	±20	75-125	TBD	±20	75-125
Butanone, 2- (MEK)	8240[c]	10 μg/kg	±20	75-125	TBD	±20	75-125
Carbon tetrachloride	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Chloroform	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Ethyl Ether	8240[c][j]	TBD μg/kg	±20	75-125	TBD	±20	75-125
Methylene chloride	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Toluene	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Trichloroethane, 1,1,1-	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Trichloroethane, 1,1,2-	8240[c]	5 μg/kg	±20	75-125	TBD	±20	75-125
Formaldeyde	8270[c][j]	TBD μg/kg	±20	75-125	TBD	±20	75-125
Kerosene	8270[c][j]	5,000 μg/kg	±20	75-125	TBD	±20	75-125
Tributyl Phosphate	8270[c][j]	TBD μg/kg	±20	75-125	TBD	±20	75-125
Polychlorinated Biphenyls	8080[c]	21 or 33 μg/kg	±20	75-125	TBD	±20	75-125
Naphthalene	8270[c]	660 μg/kg	±20	75-125	TBD	±20	75-125
Arsenic	7060[c]	0.3 mg/kg	±20	75-125	TBD	±20	75-125
Barium	6010[c]	1 mg/kg	±20	75-125	TBD	±20	75-125
Beryllium	6010[c]	1 mg/kg	±20	75-125	5 mg/l	±20	75-125
Bismuth	7471[c]	TBD mg/kg	±20	75-125	TBD	±20	75-125
Boron	6010[c]	10 mg/kg	±20	75-125	TBD	±20	75-125

Table QAPjP-1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the 200-BP-11 Source Operable Unit.

Analyte	Analytical Method	Target Quantitation Limit Soil[a]	Precision, Soil[b]	Accuracy, Soil[b]	Target Quantitation Limit Water[a]	Precision, Water[b]	Accuracy, Water[b]
Cadmium	6010[c]	2 mg/kg	±20	75-125	2 mg/l	±20	75-125
Chromium	6010[c]	2 mg/kg	±20	75-125	10 mg/l	±20	75-125
Copper	6010[c]	2 mg/kg	±20	75-125	10 mg/l	±20	75-125
Iron	6010[c]	10 mg/kg	±20	75-125	30 mg/l	±20	75-125
Lead	6010 or 7421[c]	10 or 0.3 mg/kg (respectively)	±20	75-125	5 mg/l	±20	75-125
Manganese	6010[c]	1 mg/kg	±20	75-125	5 mg/l	±20	75-125
Mercury	7471[c][e]/245.2[c][d]	0.1 mg/kg	±20	75-125	0.1 mg/l	±20	75-125
Nickel	6010[c]	4 mg/kg	±20	75-125	10 mg/l	±20	75-125
Potassium	6010[c]	500 mg/kg	±20	75-125	TBD	±20	75-125
Selenium	6010 or 7740[c]	25 or 0.3 mg/kg (respectively)	±20	75-125	TBD	±20	75-125
Silver	6010[c]	20 mg/kg	±20	75-125	10 mg/l	±20	75-125
Tin	7870[c]	50 mg/kg	±20	75-125	TBD	±20	75-125
Vanadium	6010[c]	2 mg/kg	±20	75-125	TBD	±20	75-125
Zinc	6010	2 mg/kg	±20	75-125	5 mg/l	±20	75-125
Acetate	8270[c][j]	TBD	±20	75-125	TBD µg/l	±20	75-125
Ammonia	350.2	TBD	±20	75-125	30 µg/l	±20	75-125
Cyanide	9010[c][e]/320.3[c][d]	TBD	±20	75-125	0.8 µg/l	±20	75-125

Table QAPjP-1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the 200-BP-11 Source Operable Unit.

Analyte	Analytical Method	Target Quantitation Limit Soil[a/]	Precision, Soil[b/]	Accuracy, Soil[b/]	Target Quantitation Limit Water[a/]	Precision, Water[b/]	Accuracy, Water[b/]
Fluoride	EPA 300/modified[d/g/]	TBD	±20	75-125	6 μg/L	±20	75-125
Nitrate	EPA 300 modified and 353[g/]	1.0 mg/kg	±20	75-125	51 μg/L	±20	75-125
Nitrite	EPA 300 modified and 353[g/]	1.0 mg/kg	±20	75-125	100 μg/L	±20	75-125
Sulfate	EPA 300	TBD	±20	75-125	150 μg/l	±20	75-125
Tritium (water only)	906.0[d/h/]	--	--	--	400 pCi/L	±20	75-125
Americium-241	Am-01[d/k/]/Am-02[d/]	1 pCi/g	±30	±25	1 pCi/L	±25	±25
Barium-134m (Cesium-137)[m/]	D3649 M	0.1 pCi/g	±30	±25	15 pCi/L	±25	±25
Cobalt-60	D3649 M	0.05 pCi/g	±30	±25	25 pCi/L	±25	±25
Curium-244	907.0 M[e/h/]/ 907.0[d/h/]	1.0 pCi/g	±30	±25	1 pCi/L	±25	±25
Europium-152	D3649 M[o/]	0.1 pCi/g	±30	±25	50 pCi/L	±25	±25
Europium-154	D3649 M[o/]	0.1 pCi/g	±30	±25	50 pCi/L	±25	±25
Europium-155	D3649 M[o/]	0.1 pCi/g	±30	±25	50 pCi/L	±25	±25
Iodine-129	902.0 M[e/h/]/ 902.0[d/h/]	2.0 pCi/g	±30	±25	5 pCi/L	±25	±25
Neptunium-237	907.0 M[e/]/907.0[d/]	1.0 pCi/g	±30	±25	1 pCi/L	±25	±25
Plutonium-238	Pu-02[e/k/]/Pu[o/d/k/]	1.0 pCi/g	±30	±25	TBD	±25	±25
Plutonium-239/240	Pu-02[e/k/]/Pu[o/d/k/]	1.0 pCi/g	±30	±25	1 pCi/L	±25	±25
Plutonium-241	Pu-02[e/k/]/Pu[o/d/k/]	15.0 pCi/g	±30	±25	TBD	±25	±25

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Table QAPjP-1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the 200-BP-11 Source Operable Unit.

Analyte	Analytical Method	Target Quantitation Limit Soil[a]	Precision, Soil[b]	Accuracy, Soil[b]	Target Quantitation Limit Water[a]	Precision, Water[b]	Accuracy, Water[b]
Thorium-228	Alpha Spectometry	TBD pCi/g	±30	±25	TBD	±25	±25
Thorium-230	Alpha Spectometry	1.0 pCi/g	±30	±25	TBD	±25	±25
Thorium-232	Alpha Spectometry	1.0 pCi/g	±30	±25	TBD	±25	±25
Samarium-151	TBD	TBD pCi/g	±30	±25	TBD	±25	±25
Selenium-79	Beta Counting	5.0 pCi/g	±30	±25	TBD	±25	±25
Uranium-234	U-04[e/k]/908.0[d/h]	TBD pCi/g	±30	±25	1 pCi/L	±25	±25
Uranium-235 (Pa-231)	U-04[e/k]/908.0[d/h]	TBD pCi/g	±30	±25	1 pCi/L	±25	±25
Uranium-236	U-04[e/k]/908.0[d/h]	TBD pCi/g	±30	±25	TBD	±25	±25
Uranium-238	U-04[e/k]/908.0[d/h]	TBD pCi/g	±30	±25	1 pCi/L	±25	±25
Carbon-14 (water only)	C-01[d/n]	--	--	--	50.0 pCi/L	±25	±25
Yttrium-90 (Sr-90)[p]	Sr-02[k]	1.0 pCi/g	±30	±25	2 pCi/L	±25	±25
Technetium-99	TC-01 M[e/k]/ TC-01[d/k]	15.0 pCi/g	±30	±25	15 pCi/L	±25	±25
Gross alpha	Water 900[h] Soil 900.0M[k]	10.0 pCi/g	±30	75-125	3pCi/L	±20	75-125
Gross beta	Water 900[h] Soil 900.0 M[k]	15.0 pCi/g	±30	75-125	4 pCi/L	±20	75-125
GROUNDWATER PARAMETERS							
Specific Conductance	[l]	NA	NA	NA	25 μmhos/cm	±20	NA
pH	[l]	NA	NA	NA	NA	NA	NA
Temperature	[l]	NA	NA	NA	NA	±1°C	NA

Analyte	Method	Limit Soil	Soil	Soil	Limit Water	Water	Water
Dissolved Oxygen	360.1[f]	NA	NA	NA	100 μg/L	±20	NA
Total Disolved Solids	160.1[f]	NA	NA	NA	10,000 μg/L	±20	NA
Total Organic Carbon	415.1[f]	NA	NA	NA	1,000 μg/L	±20	75-125
Turbidity	180.1[f]	NA	NA	NA	0.05 NTU	±.05 NTU	NA
Soil Physical and Chemical Properties	--	NA	NA	NA	NA	NA	NA
Bulk Density	ASTM D3550-87	--	--	--	--	--	--
Particle Size Distribution	ASTM D433	--	--	--	--	--	--
Moisture Content	ASTM D2216-90	--	--	--	--	--	--
$CaCO_3$ Content	ASTM D4373	--	--	--	--	--	--
Saturated Hydraulic Conductivity	ASTM D5084						
Unsaturated Hydraulic Conductivity	--	--	--	--	--	--	--
Matric Potential and Soil Moisture Retention Curves	ASTM D2325-68, D3152-72	--	--	--	--	--	--
Particle Density	ASTM D854	--	--	--	--	--	--
Cation Exchange Capacity	SW 846 9081	--	--	--	--	--	--
Organic Carbon Content	SW 846 9060	--	--	--	--	--	--
Iron and Manganese Content	--	--	--	--	--	--	--

Table QAPjP-1. Analytical Methods, Analytes of Interest, Quantitation Limits, and Precision and Accuracy Guidelines for the 200-BP-11 Source Operable Unit.

Analyte	Analytical Method	Target Quantitation Limit Soil[a]	Precision, Soil[b]	Accuracy, Soil[b]	Target Quantitation Limit Water[a]	Precision, Water[b]	Accuracy, Water[b]
pH and if possible Eh	ASTM G51, SW 846 9050	--	--	--	--	--	--
Minerology	--	--	--	--	--	--	--

[a] Values are to be considered requirements in the absence of known or suspected analytical interferences which may hinder achieving the limit by the analytical laboratory.

[b] Precision is expressed as relative percent difference; accuracy is expressed as percent recovery. These limits apply to sample results greater than five times the target quantitation limit and are to be considered requirements in the absence of known or suspected analytical interferences which may hinder achieving the limit by the analytical laboratory.

[c] Methods specified from *Test Methods for Evaluating Solid Waste: Chemical/Physical Methods* (EPA 1990).

[d] Water analysis.

[e] Soil analysis.

[f] Methods specified from *Methods for Chemical Analysis of Water and Wastes* (Kopp and McKee 1983).

[g] Method is from *Determination of Inorganic Anions in Aqueous and Solid Samples by Ion Chromatography* (Lindahl 1984) and is modified from EPA method 300.0.

[h] Methods from *Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (Krieger and Whittaker 1980) or an equivalent method.

[i] Methods, quantitation limits, and target values for precision and accuracy shall be developed in compliance with Westinghouse Hanford or Westinghouse Hanford-approved participant contractor or subcontractor procedures.

[j] 1-butanol and ethyl ether will analzed as a Tentantively Identified Compounds (TICs) under 8240. Formaldehyde, kerosene, and acetate will be analyzed as TICs under 8270. Tributyl Phosphate will be analyzed using a special calibration under 8270. Additionally, all RCRA TSD waste management unit (excluding the Expansion Ponds) samples will include analyzes for the volatile (8240) and semi-volatile (8270) Tentantive Identified Compounds (TICs).

[k] Applicable methods shall be selected from the *EML Procedures Manual* (Volchok and dePlanque 1982) or an equivalent method.

[l] Parameter measured in the field in compliance with EII 5.8, "Groundwater Sampling."

[m] The first radionuclide is analyzed in order to derive a concentration for the radionuclide in parentheses.

[n] Method from Radiochemistry Procedures Manual, Eastern Environmental Radiation Facility (EPA 1987) or an equivalent method.

[o] Method from Standard Test Method for High-Resolution Gamma-Ray Spectrometry of Water (ASTM 1991) or equivalent method. Soils counted using reproducible geometry, e.g., Marinelli beakers of Petri dishes and standards with sand matrix.

Table QAPjP-2. Sampling and Investigative Procedures for Field Investigations. (sheet 1 of 2)

Procedure Title or Subject[a/]	Task Number			
	2	3	4	5
EII 1.1 Hazardous Waste Site Entry Requirements	X	X	X	--
EII 1.2 Preparation and Revision of Environmental Investigations and Instructions	X	X	X	X
EII 1.4 Instruction Change Authorizations	X	X	X	X
EII 1.5 Field Logbooks	X	X	--	--
EII 1.6 Record Processing	X	X	X	X
EII 1.7 Indoctrination, Training, and Qqualification	X	X	X	X
EII 1.12 Performance Audits	X	X	X	X
EII 1.14 Preparation of Descriptions of Work	X	X	X	X
EII 2.1 Preparation of Site-Specific Health and Safety Plans	X	X	X	--
EII 2.2 Occupational Health Monitoring	X	X	X	--
WHC-CM-4-12 Health Physics Practices Manual	X	X	X	--
EII 3.2 Calibration and Control of Monitoring Instruments	X	--	X	X
EII 4.2 Interim Control of Unknown, Suspected, Hazardous and Mixed, and Radioactive Waste	X	X	X	--
EII 4.3 Control of CERCLA and Other Past-Practice Investigation Derived Waste	X	--	X	X
EII 5.1 Chain of Custody	X	--	X	X
EII 5.2 Soil and Sediment Sampling	X	X	--	--
EII 5.4 Field Cleaning and/or Decontamination of Equipment	--	--	--	X
EII 5.5 Laboratory Cleaning of RCRA/CERCLA Sampling Equipment	X	--	X	X
EII 5.7A Hanford Geotechnical Sample Library Control	--	--	--	--
EII 5.8 Groundwater Sampling	X	--	--	X
EII 5.9 Soil-Gas Sampling	X	--	--	--

Table QAPjP-2. Sampling and Investigative Procedures for Field Investigations. (sheet 2 of 2)

Procedure Title or Subject[a/]	Task Number			
	2	3	4	5
EII 5.10 Obtaining Sample Identification Numbers and Accessing HEIS data	X	--	X	X
EII 5.11 Sample Packaging and Shipping	X	--	X	X
EII 6.7 Documentation of Well Drilling and Completion Operations	--	--	--	X
EII 6.10 Abandoning/Decommissioning Groundwater Wells	X	--	--	--
EII 9.1 Geologic Logging	--	--	--	X
EII 10.2 Measurement of Groundwater Levels	--	--	--	0X
EII 10.3 Purgewater Management	--	--	--	X
EII 11.1 Geophysical Logging	X	--	--	--
EII 11.2 Geophysical Survey Work	--	--	--	X

[a/] Procedures are latest version of WHC Environmental Investigations Instructions (EIIs) selected from the *Environmental Investigations and Site Characterization Manual* (WHC 1988b) unless otherwise specified.

Table QAPjP-3. Required Preservation, Container, and Holding Times.

Parameter	Preservation	Container	Holding Times
Total Extractable Petroleum Hydrocarbons	Cool to 4 °C;	Glass, Teflon-lined Cap	7 days for extraction, then 40 days for analysis
Volatile Organics	Cool to 4 °C; Water Samples: Adjust to pH<2 with HCl	Glass, Teflon-lined Cap	14 days
Metals	Cool to 4 °C; Water Samples: Adjust to pH<2 with HNO_3	Polyethylene or Glass	Acid digestion within 1 month and analysis within 6 months of sample collection
Mercury	Cool to 4 °C; Water Samples: Adjust to pH<2 with HNO_3	Polyethylene or Glass	28 days
Cyanide, Total	Cool to 4 °C; Water Samples: Adjust to pH>12 with NaOH	Polyethylene or Glass	14 days
Total Fluoride	Cool to 4 °C	Polyethylene	28 days
Radionuclides	--	Polyethylene	6 months
Nitrate/Nitrite	Cool to 4 °C; Water samples: adjust to pH<2 with H_2So_4	Glass	28 days
Tributyl Phosphate	Cool to 4 °C; water samples: Adjust to pH<2 with HCl	Glass, Teflon Lined Cap	14 days
Semivolatiles/Kerosene	Cool to 4 °C	Glass, Teflon Lined Cap	7 days for extraction, then 40 days for analysis.

Table QAPjP-4. Quality Assurance Control Samples.

Parameters	Field[a/] Samples	Duplicate Sample	Field and Equipment Rinsate Blanks	Trip Blank	MS/MSD[b/]
Physical Properties - Type A[c/]	55	6	NA	NA	NA
Physical Properties - Type B[d/]	18	2	NA	NA	NA
Organics, Inorganics, and Rad	121	12	12	TBD	TBD

a/ Approximate number of field samples.

b/ Matrix spike/matrix spike duplicates are described in Section 9.2 of the QAPjP; one sample per analytical batch or one in every 10 samples shall be analyzed.

c/ Type A samples will be run for the following analyses: moisture content, bulk density, particle-size distribution, and $CaCO_3$ (samples from the test pits will not be run for bulk density).

d/ Type B samples will be run for Type A analyses: saturated hydraulic conductivity, cation exchange capacity, moisture retention curves, organic carbon content, iron and manganese content, pH, and if possible, Eh and mineralogy.

Table QAPjP-5. Soil Physical Parameters for the 200-BP-11 Source Operable Unit.

Parameter	ASTM or Other Standard Method
Bulk density	[a/]
Particle size distribution	D-422[b/]
Permeability	D-2434[b/]
Moisture content	D-2216[b/]

[a/] Method shall be developed by the laboratory contractor and submitted for WHC review and approval before use.

[b/] Method is from the *1991 Annual Book of ASTM Standards* (ASTM 1991).

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APPENDIX B

200-BP-11 RCRA TSD UNIT FORM 3'S FOR THE HANFORD SITE PART A PERMIT APPLICATION

CONTENTS

216-B-3 MAIN POND FORM 3

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FORM 3

DANGEROUS WASTE PERMIT APPLICATION

1. EPA/STATE I.D. NUMBER

W A 7 8 9 0 0 0 8 9 6 7

I. FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (mo., day, & yr.)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

MO.	DAY	YR.
0 4		4 5

FOR EXISTING FACILITIES, PROVIDE THE DATE *(mo., day, & yr.)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

☐ 2. NEW FACILITY *(Complete item below)*

MO.	DAY	YR.

FOR NEW FACILITIES, PROVIDE THE DATE *(mo., day, & yr)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Section I above)*

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES - CODES AND CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the *(Section III-C)*.

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.

2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D82	ACRES OR HECTARES
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING SECTION III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE *(from list above)*	B. 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE *(from list above)*	B. 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	T 0 2	840,000	U		7				
2	D 8 4	840,000	G		8				
3					9				
4					10				

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...CESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

T02, D84

The 216-B-3 Main Pond (Main Pond) consists of the 216-B-3 Pond and the 216-B-3-3 Ditch. The 216-B-3 Pond, which has been in service since 1945, currently covers an area of 35 acres (14 hectares) to a depth of 2 to 8 feet (.71 to 2.4 meters). The 216-B-3 Pond receives effluent from the 216-B-3-3 Ditch, which was excavated in 1970 to replace an earlier ditch. The 216-B-3-3 Ditch is approximately 3,700 feet (1,128 meters) long, 30 feet (9.1 meters) wide at ground level, 6 feet (1.8 meters) wide at the bottom, and 4 to 8 feet (1.2 to 2.4 meters) deep. The 216-B-3-3 Ditch received most of its dangerous waste from the 216-A-29 Ditch, which drained the Plutonium Uranium Extraction (PUREX) Plant chemical sewer line. The 216-A-29 Ditch discharged into the 216-B-3-3 Ditch approximately 1,500 feet (460 meters) west of the 216-B-3 Pond. The 216-A-29 Ditch was shut down and interim stabilized in July 1991.

The Main Pond receives waste water (primarily process and cooling water) from the PUREX Plant, the B Plant Complex, the 242-A Evaporator, and other 200 East Area units. Effluent in excess of the amount that the Main Pond is designed to handle is transferred through a spillway to the 216-B-3 Expansion Ponds. The Main Pond received corrosive waste as a result of the regeneration of the PUREX Plant demineralizer columns (D84). Treatment of the waste occurred by the successive discharge of acidic and caustic waste, which served to neutralize the corrosivity of the waste before and upon reaching the Main Pond. Residual corrosivity was neutralized by the calcareous nature of the Main Pond soil (T02).

The process design capacities given for waste process codes T02 [840,000 gallons (3,180,000 liters) per day] and D84 [840,000 gallons (3,180,000 liters)] represent the Main Pond's proportional share (based on percolation capacity) of the process design capacity of the entire B Pond System (which includes the 216-B-3 Expansion Ponds, a separate dangerous waste treatment and disposal unit). At the peak of operations, approximately 22,000,000 gallons (83,280,000 liters) per day of liquid was discharged to the entire 216-B-3 Pond System. Presently, approximately 1,500 gallons (5,678 liters) to 6,000 gallons (22,712 liters) per minute of non-dangerous liquid effluent are being sent to the 216-B-3 Pond System.

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER - Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE - For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2			T 0 3 D 8 0	*included with above*

CONTINUE ON PAGE 3

ued from page 2.
Photocopy this page before completing if you have more than 26 wastes to list.

ɪUMBER *(entered from page 1)*

W A 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	D002	3,500,000	P	T02	D84			Neutralization/Percolation
2	WT02	77,000	↓	↓	↓			included with above
3	U133	417,000	P	T02	D84			Neutralization/Percolation
4	WT01	19,000	P	T02	D84			Neutralization/Percolation
5	D006	169,000	↓	↓	↓			included with above
6								
7								
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IV. DESCRIPTION OF DANGEROUS WASTES (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The 216-B-3 Main Pond (Main Pond) received dangerous waste from two main sources: (1) corrosive and toxic dangerous waste resulting from the regeneration of demineralizer columns at the PUREX Plant, and (2) spills of dangerous or mixed waste at the PUREX Plant. Backwash from the regeneration of the demineralizer columns was frequently corrosive (D002) and sometimes contained toxic concentrations of chemicals used in the regeneration process, including nitric acid, sulfuric acid, sodium hydroxide, and potassium hydroxide (WT02). Spills at the PUREX Plant included hydrazine (U133), cadmium nitrate (WT01/D006), and ammonium fluoride/ammonium nitrate (WT01). Since 1984, administrative and engineering barriers have been put in place at the PUREX Plant to prevent dangerous waste from being discharged into the Main Pond.

The quantity of waste listed for D002/WT02 is an estimated annual quantity based on the Main Pond's proportional share (based on percolation capacity) of the amount of corrosive and toxic waste received by the entire 216-B-3 Pond System (which includes the 216-B-3 Expansion Ponds, a separate dangerous waste treatment and disposal unit). The quantities of waste listed for U133 and WT01/D006 represent the Main Pond's proportional share (based on percolation capacity) of the total recorded amount of hydrazine, cadmium, and ammonium fluoride/ammonium nitrate received by the entire 216-B-3 Pond System from the time the PUREX Plant resumed operations in 1983 until the last known chemical discharge occurred in 1987.

The quantities of waste listed for U133 and WT01/D006 include the water in which the chemicals were discharged. Water makes up most of the weight of these discharges.

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 6 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground-level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION — This information is provided on the attached drawings and photos.

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

[x] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
John D. Wagoner, Manager U.S. Department of Energy Richland Operations Office	John D. Wagoner	12/16/93

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

CONTINUE ON PAGE 5

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

John D. Wagoner

Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

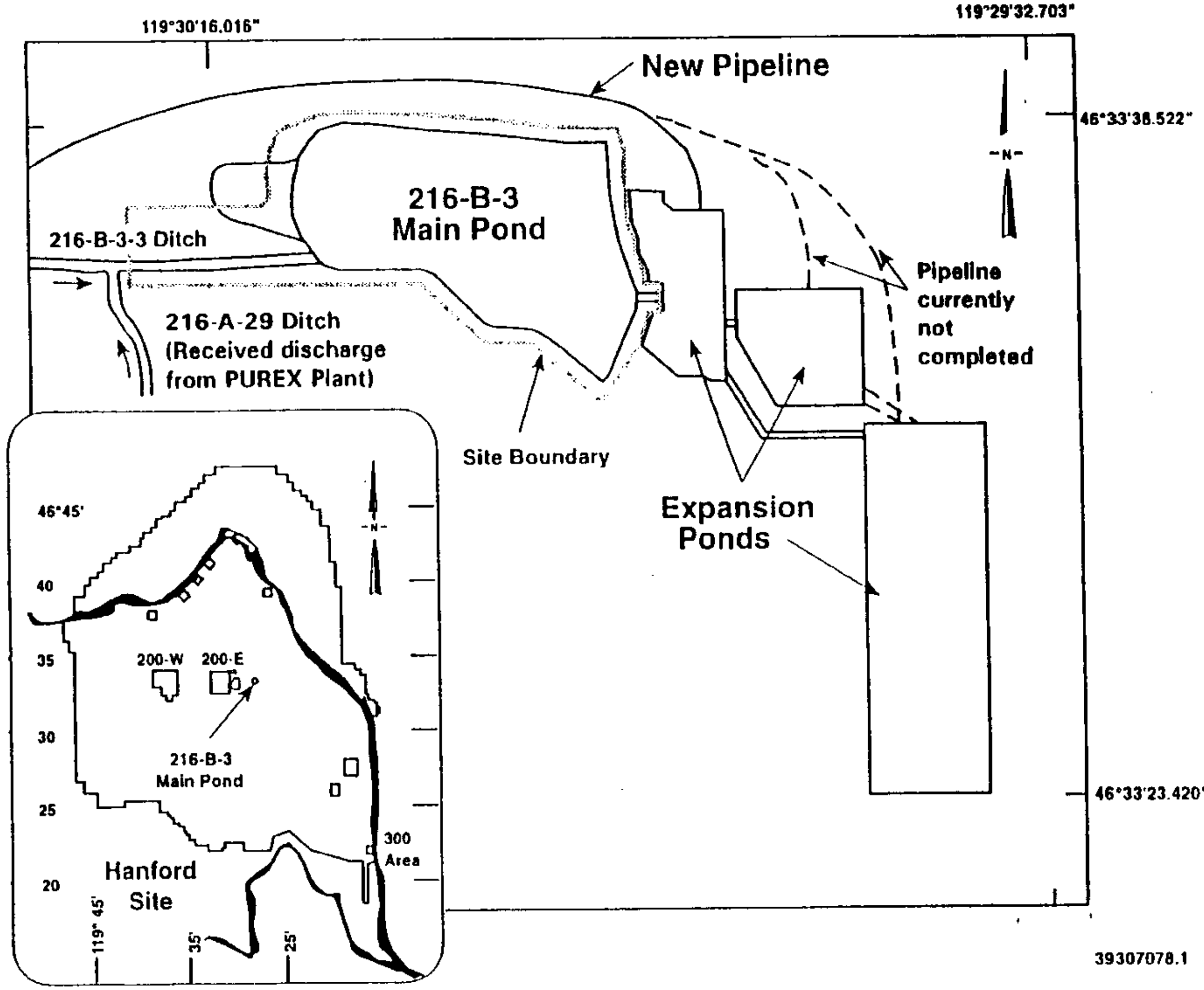
12/16/93
Date

Thomas M. Anderson

Co-operator
Thomas M. Anderson, President
Westinghouse Hanford Company

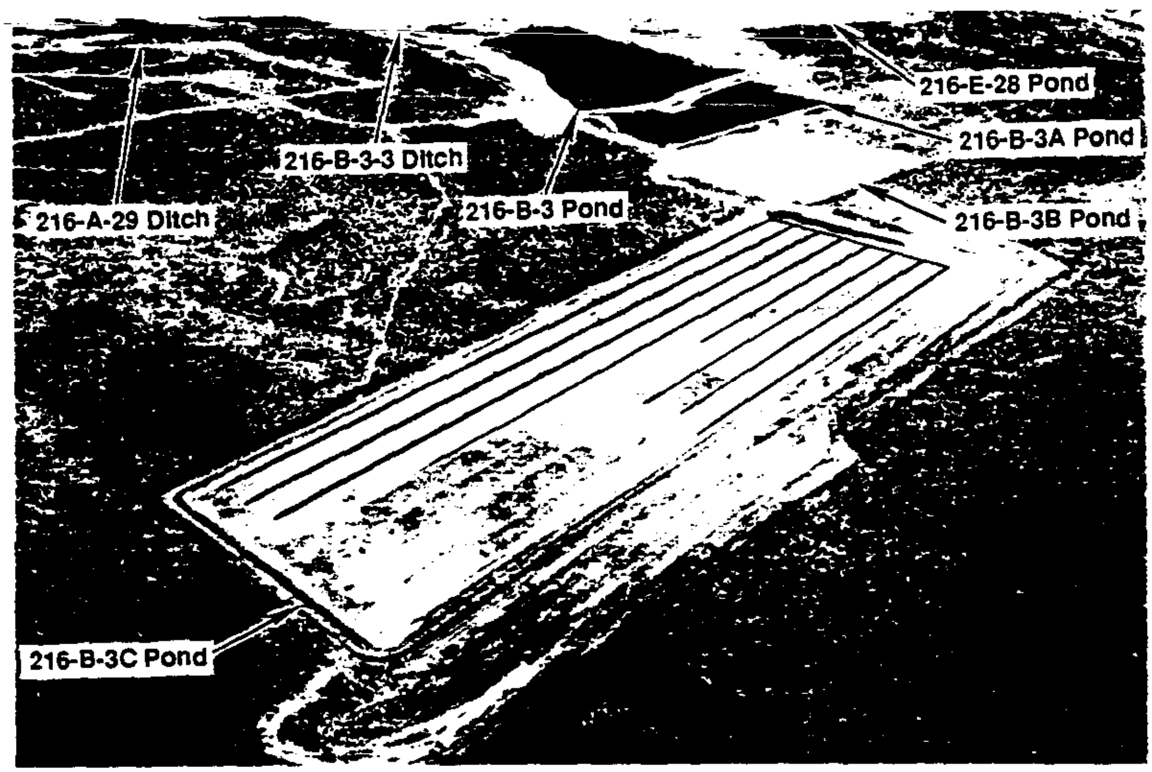
12/1/93
Date

216-B-3 Main Pond



39307078.1

216-B-3 Main Pond



46°33'38.522"
46°33'23.420"
119°30'16.016"
119°29'32.703"

93110825-1CN
(PHOTO TAKEN 1993)

216-B-3 EXPANSION PONDS FORM 3

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 character/inch).

3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/STATE I.D. NUMBER

W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (mo., day, & yr.)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☐ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

MO.	DAY	YR.
1 0		8 3

FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

☐ 2. NEW FACILITY (Complete item below)

MO.	DAY	YR.

FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Section I above)

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES - CODES AND CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the (Section III-C).

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.

2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D82	ACRES OR HECTARES
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING SECTION III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G	
X-2	T 0 3	20	E	
1	T 0 2	27,960,000	U	
2	D 8 4	27,960,000	G	
3				
4				
5				
6				
7				
8				
9				
10				

C[illegible] ed from the front.

[illegible]CESSES (continued)

[illegible]ACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

T02, D84

The 216-B-3 Expansion Ponds (Expansion Ponds) consist of three interconnected ponds called the 216-B-3A (3A) Pond, the 216-B-3B (3B) Pond, and the 216-B-3C (3C) Pond. These ponds were constructed to receive the increased discharges to the 216-B-3 Pond System, which includes the 216-B-3 Main Pond (Main Pond), a separate dangerous waste treatment and disposal unit as a result of the restart of the Plutonium Uranium Extraction (PUREX) Plant in 1983 and the decommissioning of the Gable Mountain Pond in 1987. The 3A Pond was placed into service in October 1983 and remains in service today. The 3A Pond receives effluent from the Main Pond through a spillway in the dike separating the two ponds. A similar spillway allowed the 3B Pond, which was operational from June 1984 to May 1985, to receive effluent from the 3A Pond. The 3A and 3B Ponds each cover an area of approximately 11 acres (4.4 hectares). The 3C Pond began operation in 1985 and is still in service today. The 3C Pond was constructed by excavating 6 feet (1.8 meters) of soil over a 41-acre (16-hectare) surface area. A spillway similar to the ones used for the 3A and 3B Ponds conveys effluent from the 3A Pond to the 3C Pond.

Waste water (primarily process and cooling water) from the PUREX Plant, the B Plant Complex, the 242-A Evaporator, and other 200 East Area units is received by the expansion ponds through the Main Pond. The Expansion Ponds received corrosive waste as a result of the regeneration of the PUREX Plant demineralizer columns (D84). Treatment of the waste occurred by the successive discharge of acidic and caustic waste, which served to neutralize the corrosivity of the waste before and upon reaching the Expansion Ponds. Residual corrosivity was neutralized by the calcareous nature of the Expansion Ponds soil (T02).

The process design capacities given for the waste process codes T02 [27,960,000 gallons (105,840,000 liters) per day] and D84 [27,960,000 gallons (105,840,000 liters)] represent the Expansion Ponds proportional share (based on percolation capacity) of the process design capacity of the entire B Pond System. At the peak of operations, approximately 22,000,000 gallons (83,280,000 liters) per day of liquid was discharged to the entire 216-B-3 Pond System. Presently, approximately 1,500 gallons (5,678 liters) to 6,000 gallons (22,712 liters) per minute of nondangerous liquid effluent are being sent to the 216-B-3 Pond System.

Construction was begun on a new pipeline in 1990 that will allow waste water to bypass the 216-B-3 Main Pond and discharge directly to the Expansion Ponds.

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER - Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE - For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X	0 6 4	900	P	T 0 3 D 8 0	
	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2			T 0 3 D 8 0	*included with above*

CONTINUE ON PAGE 3

Continued from page 2.
Photocopy this page before completing if you have more than 26 wastes to list.

[illegible]BER *(entered from page 1)*: 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
1	D002	117,200,000	P	T02	D84			Neutralization/Percolation
2	WT02	2,573,000	↓	↓	↓			included with above
3	U133	1,478,000	P	T02	D84			Neutralization/Percolation
4	WT01	484,000	P	T02	D84			Neutralization/Percolation
5	D006	149,000	↓	↓	↓			included with above
6								
7								
8								
9								
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.SCRIPTION OF DANGEROUS WASTES (continued)

JSE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The 216-B-3 Expansion Ponds (Expansion Ponds) received dangerous waste from two main sources: (1) corrosive and toxic dangerous waste resulting from the regeneration of demineralizer columns at the PUREX Plant, and (2) spills of dangerous or mixed waste at the PUREX Plant. Backwash from the regeneration of the demineralizer columns was frequently corrosive (D002) and sometimes contained toxic concentrations of chemicals used in the regeneration process, including nitric acid, sulfuric acid, sodium hydroxide, and potassium hydroxide (WT02). Spills at the PUREX Plant included hydrazine (U133), cadmium nitrate (WT01/D006), and ammonium fluoride/ammonium nitrate (WT01). Since 1984, administrative and engineering barriers have been put in place at the PUREX Plant to prevent dangerous waste from being discharged into the Expansion Ponds.

The quantity of waste listed for D002/WT02 is an estimated annual quantity based on the Expansion Ponds proportional share (based on percolation capacity) of the amount of corrosive and toxic dangerous waste received by the entire 216-B-3 Pond System (which includes the 216-B-3 Main Pond, a separate dangerous waste treatment and disposal unit). The quantities of waste listed for U133 and WT01/D006 represent the Expansion Ponds' proportional share (based on percolation capacity) of the total recorded amount of hydrazine, cadmium, and ammonium fluoride/ammonium nitrate received by the entire B Pond System from the time the PUREX Plant resumed operations in 1983 until the last known chemical discharge occurred in 1987.

The quantities of waste listed for U133 and WT01/D006 include the water in which the emicals were discharged. Water makes up most of the weight of these discharges.

ACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION This information is provided on the attached drawings and photos.

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
John D. Wagoner, Manager U.S. Department of Energy Richland Operations Office	John D. Wagoner	12/16/93

X. ERATOR CERTIFICATION

I under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on uiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME *(print or type)*	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

CONTINUE ON PAGE 5

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

John D. Wagoner

Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

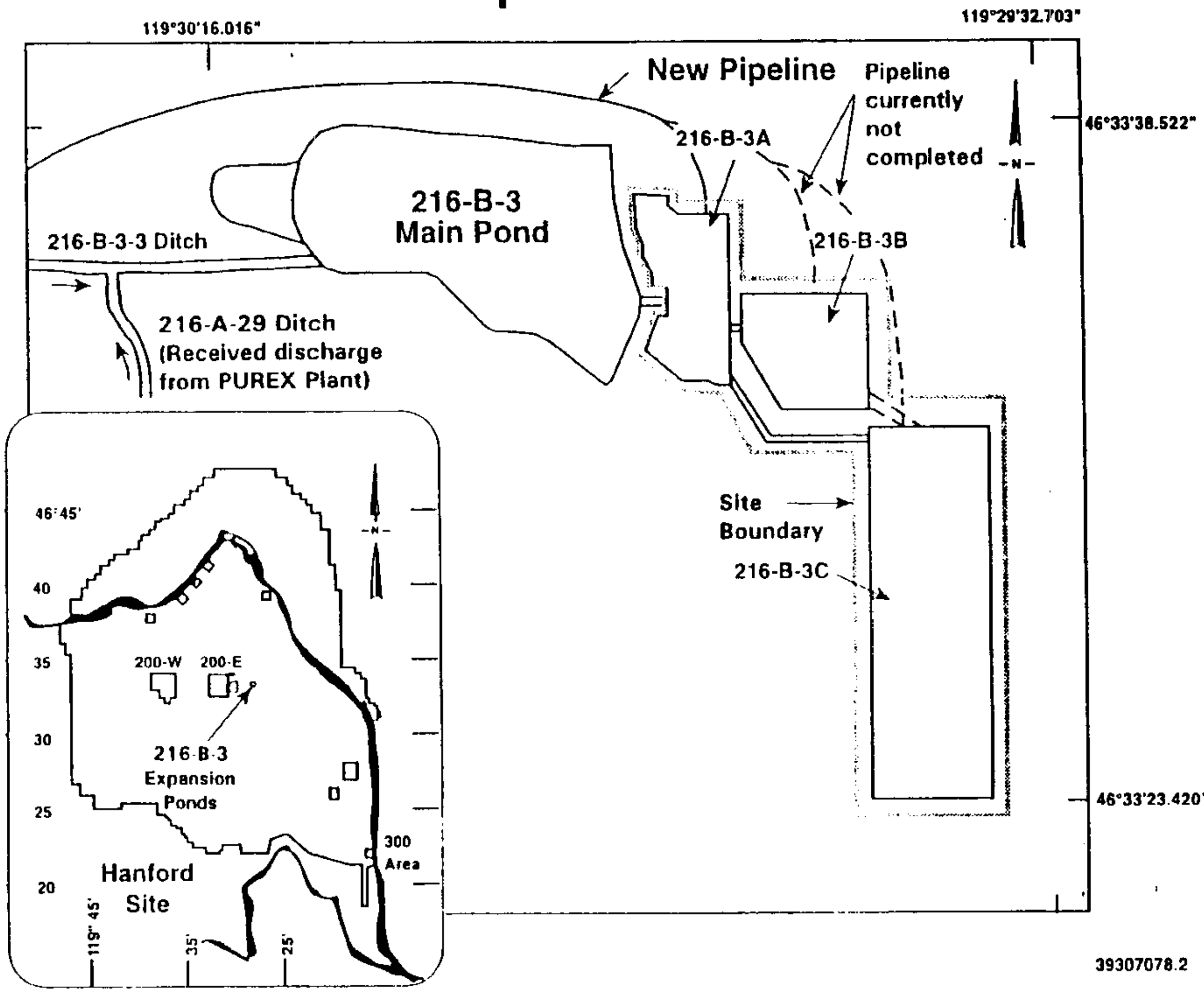
12/16/93
Date

Thomas M. Anderson

Co-operator
Thomas M. Anderson, President
Westinghouse Hanford Company

12/1/93
Date

216-B-3 Expansion Ponds



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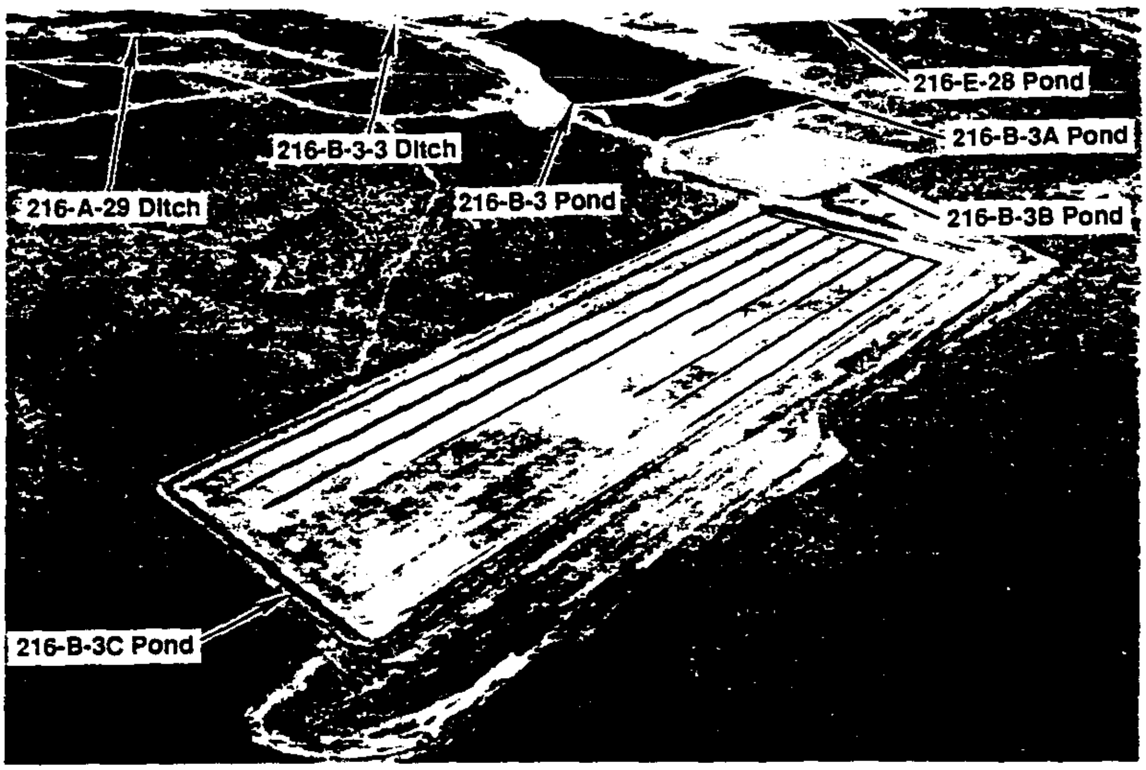
216-B-3 Expansion Ponds



46°33'38.522"
46°33'23.420"
119°30'16.016"
119°29'32.703"

93110825-1CN
(PHOTO TAKEN 1993)

LIQUID EFFLUENT RETENTION FACILITY
FORM 3

Please print or type in the unshaded areas only (fill-in areas are spaced for elite type, i.e., 12 characters/inch)

FORM 3	DANGEROUS WASTE PERMIT APPLICATION	I. EPA/STATE I.D. NUMBER: W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (mo., day, & yr.)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☐ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

MO. __ DAY __ YR. __ — FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

☒ 2. NEW FACILITY (Complete item below.)

MO. 10 DAY 01 YR. 91 — FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Section I above)

☐ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES — CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the (Section III-C).

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY	PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:			Treatment:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS	TANK	T01	GALLONS PER DAY OR LITERS PER DAY
TANK	S02	GALLONS OR LITERS	SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS	INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS			
Disposal:					
INJECTION WELL	D80	GALLONS OR LITERS			
LANDFILL	D81	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER	OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY
LAND APPLICATION	D82	ACRES OR HECTARES			
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY			
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS			

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING SECTION III (*shown in line numbers X-1 and X-2 below*): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 4	26,000,000	G		7				
2					8				
3					9				
4					10				

Continued from the front.

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

S04

The Liquid Effluent Retention Facility (LERF) is being constructed under interim status expansion in accordance with the Washington Administrative Code (WAC) 173-303-805 "Interim Status Permits." The LERF will provide interim storage of mixed waste process condensate effluent from the 242-A Evaporator until treatment is available for compliance with the dangerous waste regulations for disposal.

The LERF will be a retention basin consisting of four cells (surface impoundments) (S04). Each retention basin cell has a design capacity of 6,500,000 gallons with a total capacity of 26,000,000 gallons.

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER — Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non—listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER — Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV (shown in line numbers X-1, X-2, X-3, and X-4 below) — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3	D 8 0			
X-2	D 0 0 2	400	P	T 0 3	D 8 0			
X-3	D 0 0 1	100	P	T 0 3	D 8 0			
X-4	D 0 0 2			T 0 3	D 8 0			included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER (enter from page 1)

WA7890008967

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F003	216,975,200	P	S04	Storage - Surface Impoundment
2	F005				↓
3	WT02				Included With Above
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
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IV. DESCRIPTION OF DANGEROUS WASTES (continued)

USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3

The LERF will recieve and store mixed waste process condensate effluent from the 242-A Evaporator until treatment is available. The mixed waste process condensate effluent will be regulated as a dangerous waste under WAC 173-303.

The mixed waste process condensate effluent will be regulated as a dangerous waste due to the presence of spent nonhalogenated solvents (F003 and F005) and for the toxicity of ammonia (WT02, toxic state-only dangerous waste).

The Estimated Annual Quantity of Dangerous Waste of 216,975,200 pounds per year is based on approximately 26,000,000 gallons of waste, or the total capacity of the four cells in the retention basin.

9112203 2692

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (aerial or ground—level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

VII. FACILITY GEOGRAPHIC LOCATION

This information is provided on the attached drawings and photos

LATITUDE (degrees, minutes, & seconds)

LONGITUDE (degrees, minutes, & seconds)

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER

2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX

4. CITY OR TOWN

5. ST

6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
John D. Wagoner Manager, Richland Operations United States Department of Energy	John D Wagoner	6/26/91

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

CONTINUE ON PAGE 5

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

Owner/Operator
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

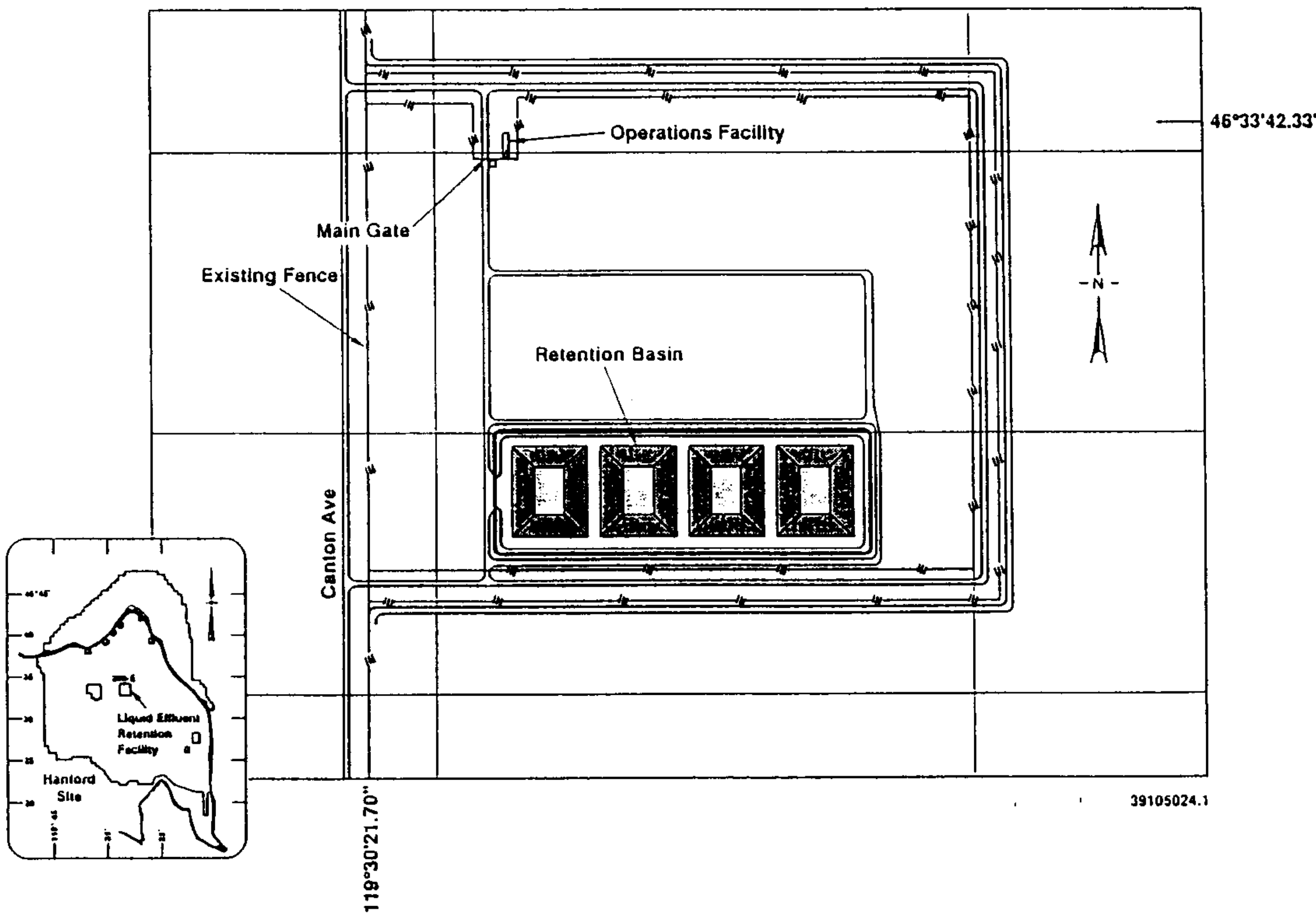
6/26/91
Date

Co-operator
Thomas M. Anderson, President
Westinghouse Hanford Company

5/28/91
Date

9413293.3699

Liquid Effluent Retention Facility
Site Plan



LIQUID EFFLUENT RETENTION FACILITY

UNDER CONSTRUCTION

46°33'42.33"
119°30'21.70"

90060637-1CN
(PHOTO TAKEN 1990)

EFFLUENT TREATMENT FACILITY
FORM 3

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 character/inch).

FORM 3

DANGEROUS WASTE PERMIT APPLICATION

I. EPA/STATE I.D. NUMBER: W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED *(mo., day, & yr.)*	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

MO.	DAY	YR.

FOR EXISTING FACILITIES, PROVIDE THE DATE *(mo., day, & yr.)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

☐ 2. NEW FACILITY *(Complete item below)*

MO.	DAY	YR.
0 3		9 3

FOR NEW FACILITIES, PROVIDE THE DATE *(mo., day, & yr.)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Section I above)*

☒ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES - CODES AND CAPACITIES

A. PROCESS CODE - Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the *(Section III-C)*.

B. PROCESS DESIGN CAPACITY - For each code entered in column A enter the capacity of the process.

1. AMOUNT - Enter the amount.
2. UNIT OF MEASURE - For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D82	*ACRES OR HECTARES*
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING SECTION III *(shown in line numbers X-1 and X-2 below)*: *A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons.* The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE *(from list above)*	B. 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE *(from list above)*	B. 1. AMOUNT *(specify)*	2. UNIT OF MEASURE *(enter code)*	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
	0 1	216,000	U		7				
	S 0 2	2,010,000	G		8				
3	S 0 1	39,600	G		9				
4					10				

Continued from the front.

PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACI

T01, S02

The 200 Area Effluent Treatment Facility (ETF) is being constructed to treat and store process condensate from the 242-A Evaporator, and the Liquid Effluent Retention Facility, and possibly other Hanford Facility waste that falls within the envelope of acceptable waste at the ETF. The ETF is located in the northeast corner of the 200 East Area. The treatment process includes filtration, pH adjustment, ultraviolet oxidation, hydrogen peroxide decomposition, degasification, reverse osmosis, ion exchange, effluent quality verification in tanks, evaporation, concentration, and thin film drying (T01). The treated effluent is stored in three verification tanks (S02) and sampled to determine if the effluent meets required discharge standards. When the effluent meets the discharge standards as established by the regulations, the effluent will be discharged to the soil. If the sample analysis of the effluent in the verification tanks does not meet the discharge standards, the effluent will be sent back through the system for further treatment.

The treatment process is designed to treat a maximum of 150 gallons (568 liters) per minute or 216,000 gallons (817,650 liters) per day. The tank storage is designed to store a maximum of 2,010,000 gallons (7,610,000 liters).

S01

A secondary waste stream is generated during operation of the ETF. This secondary waste is concentrated into a powder, containerized, and transferred to the Central Waste Complex for storage while disposal options are evaluated. Other mixed waste generated and containerized during the operation of the ETF includes dewatered spent bead resin, spent membranes, spent high-efficiency particulate air cartridges, spent filter elements, spent activated carbon cartridges, and spent ultraviolet lamps. Nonradioactive dangerous waste includes chemicals used in the various processes. This nonradioactive dangerous waste is containerized and transferred to the 616 Nonradioactive Dangerous Waste Storage Facility.

The container storage area is designed to store a maximum of 39,600 gallons (150,000 liters).

IV. DESCRIPTION OF DANGEROUS WASTES

A. DANGEROUS WASTE NUMBER - Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. ESTIMATED ANNUAL QUANTITY - For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE - For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER - Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* - A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K054	900	P	T03 D80	
X-2	D002	400	P	T03 D80	
X-3	D001	100	P	T03 D80	
X-4	D002			T03 D80	*included with above*

...ed from page 2.
Photocopy this page before completing if you have more than 26 wastes to list.

...MBER (entered from page 1)

7 8 9 0 0 0 8 9 6 7

...TION OF DANGEROUS WASTES (continued)

A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (If a code is not entered in D(1))
0 0 1	657,935,000	P	T01	Treatment - Tank
0 0 2				
0 0 3				
0 0 4				
0 0 5				
T 0 2				Included With Above
0 0 1	67,094,000	P	S02	Storage - Tank
0 0 2				
0 0 3				
0 0 4				
0				
0 2				Included With Above
0 1	4,380,000	P	S01	Storage - Container
0 2				
0 3				
0 4				
5				
6				
7				
8				
9				
0				
1				
				B-35

Continued from the front.

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The ETF treats and stores process condensate from the 242-A Evaporator, and the Liquid Effluent Retention Facility, and possibly other dilute aqueous waste streams generated on the Hanford Facility. The effluent stored in the verification tanks for sampling is regulated as a dangerous waste because of the possible presence of spent halogenated and nonhalogenated solvents (F001 through F005) and for the toxicity of ammonia (WT02, toxic state-only dangerous waste). The secondary waste stream is regulated as a dangerous waste because of the presence of characteristic waste (D001, D002, and D003), toxic constituents (D004, D005, D006, D007, D008, D009, D010, D011, D018, D019, D022, D028, D029, D030, D033, D034, D035, D036, D038, D039, D040, D041, and D043), spent halogenated and nonhalogenated solvents (F001 through F005), and toxic state-only extremely hazardous waste (WT01).

The annual quantity of waste listed under item IV.B was calculated using an operating schedule of 365 days per year. This calculation was done to provide a maximum annual estimated quantity of waste that might be treated and stored by the ETF.

9413203.3707

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

VII. FACILITY GEOGRAPHIC LOCATION This information is provided on the attached drawings and photos.

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)

VIII. FACILITY OWNER

[x] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
John D. Wagoner, Manager U.S. Department of Energy Richland Operations Office	John D. Wagoner	8/25/93

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

CONTINUE ON PAGE 5

Continued from page 2.
NOTE: *Photocopy this page before completing if you have more than 26 wastes to list.*

NUMBER (entered from page 1)

A 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	D028	4,380,000	P	S01	Storage - Container (cont.)
2	D029	(cont.)			
3	D030				
4	D033				
5	D034				
6	D035				
7	D036				
8	D038				
9	D039				
	D040				
	041				
12	D043				
13	F001				
14	F002				
15	F003				
16	F004				
17	F005				
18	WT01				Included With Above
19					
20					
21					
22					
3					
5					
6					

X. OPERATOR CERTIFICATION

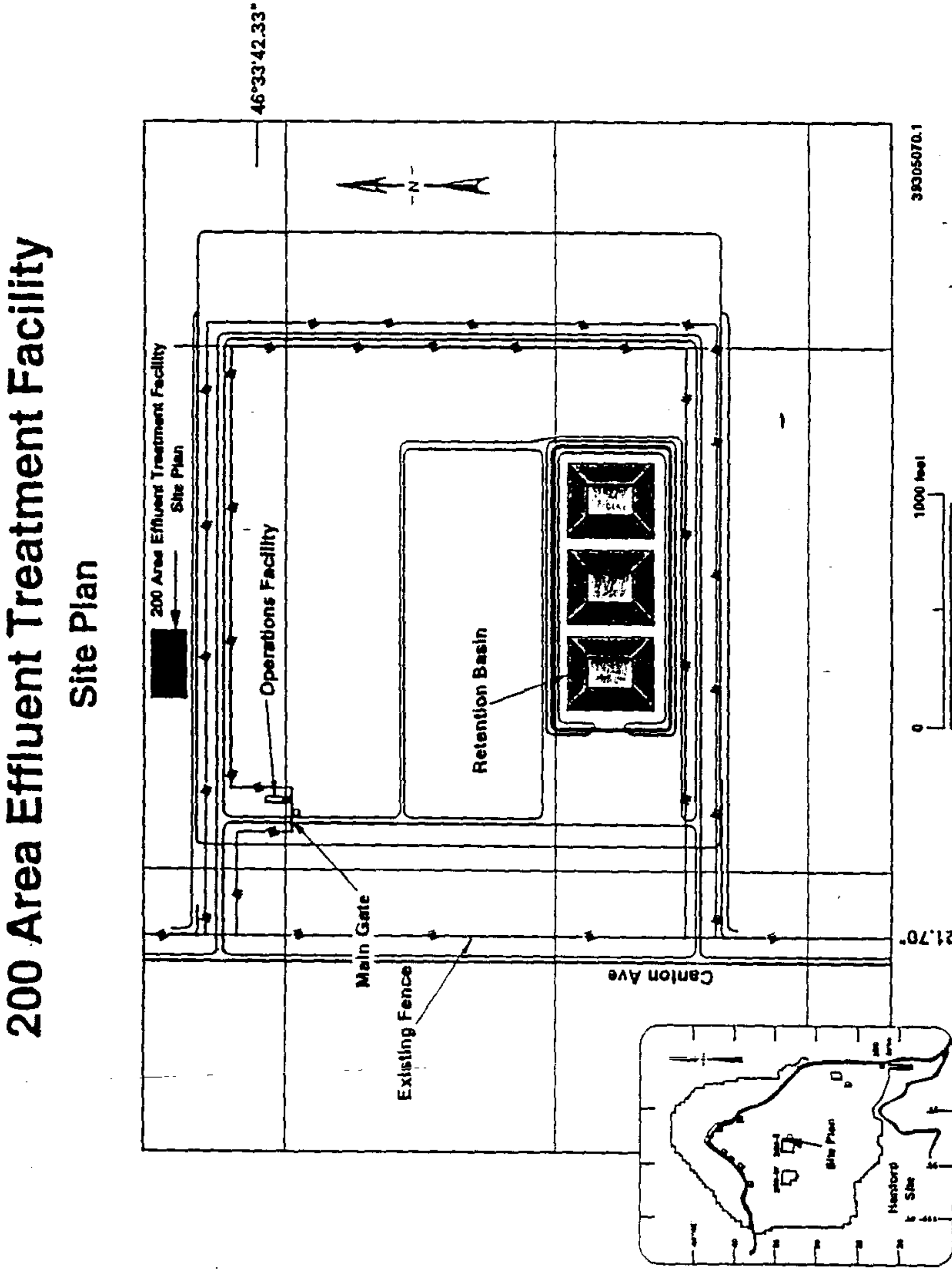
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

John D. Wagoner — 8/25/93

Owner/Operator — Date
John D. Wagoner, Manager
U.S. Department of Energy
Richland Operations Office

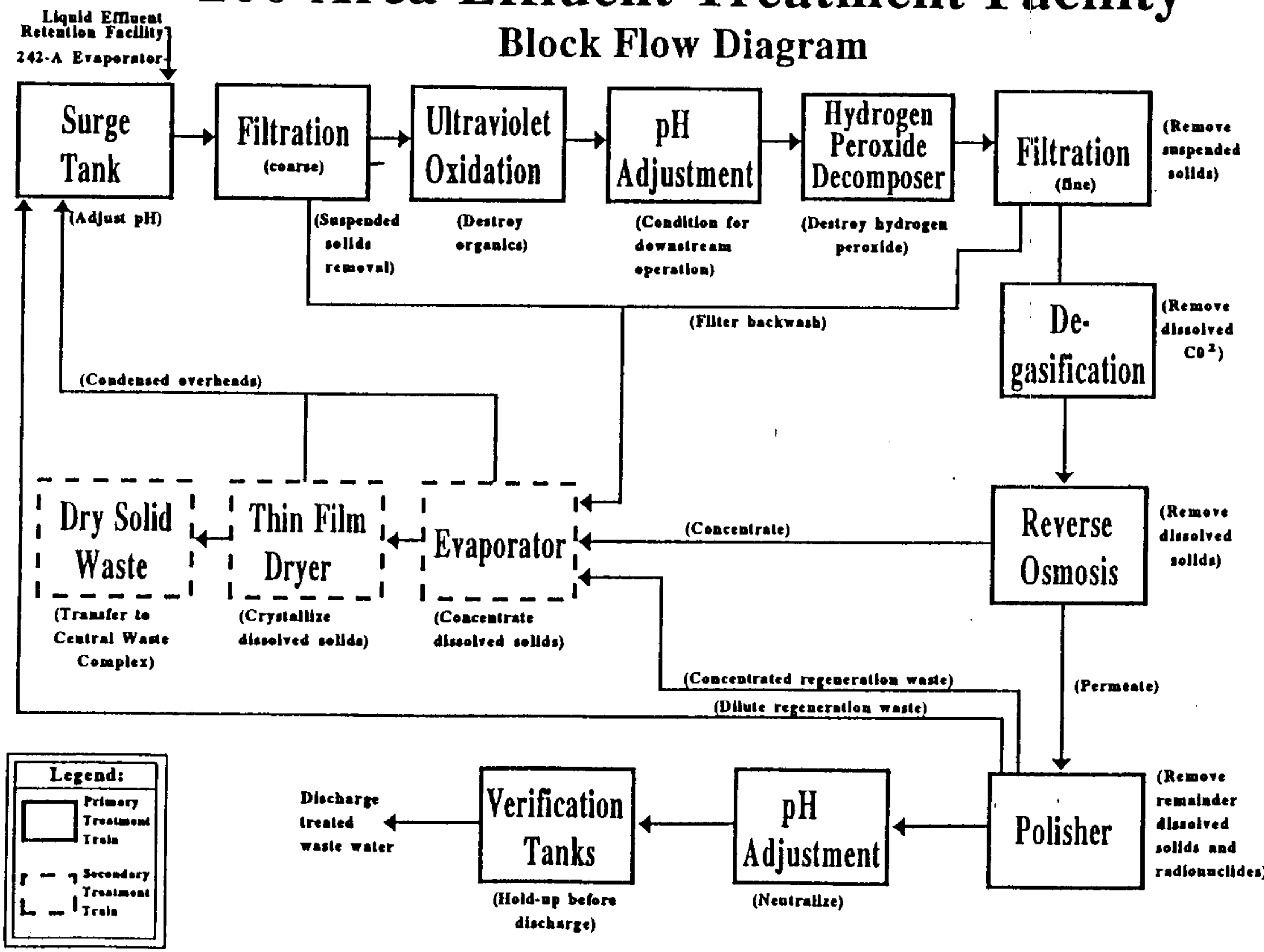
Thomas M. Anderson — 7/29/93

Co-operator — Date
Thomas M. Anderson, President
Westinghouse Hanford Company

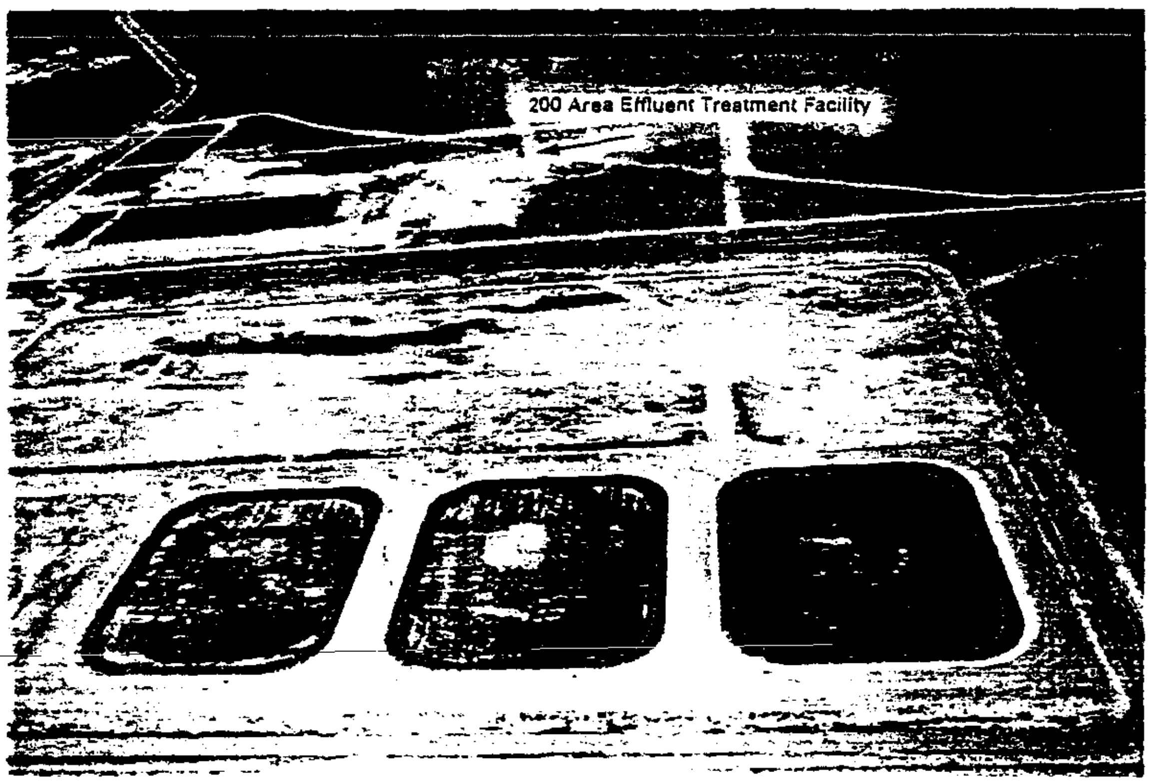

200 Area Effluent Treatment Facility
Site Plan
46°33'42.33"
N
200 Area Effluent Treatment Facility Site Plan
Operations Facility
Retention Basin
Main Gate
Existing Fence
Canton Ave
119°30'21.70"
0
1000 feet
0
300 meters
39305070.1
Site Plan
Hanford Site

200 Area Effluent Treatment Facility

Block Flow Diagram



200 AREA EFFLUENT TREATMENT FACILITY



46°33'42.33"
119°30'21.70"

93030994-79CN
(PHOTO TAKEN 1993)

PURGEWATER TANKS FORM 3

FORM 3	DANGEROUS WASTE PERMIT APPLICATION	I. EPA/STATE I.D. NUMBER: W A 7 8 9 0 0 0 8 9 6 7

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (mo., day, & yr.)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (mark one box only) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA/STATE I.D. Number, or if this is a revised application, enter your facility's EPA/STATE I.D. Number in Section I above.

A. FIRST APPLICATION (place an "X" below and provide the appropriate date)

☐ 1. EXISTING FACILITY (See instructions for definition of "existing" facility. Complete item below.)

MO.	DAY	YR.

FOR EXISTING FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (use the boxes to the left)

☒ 2. NEW FACILITY (Complete item below.)

MO.	DAY	YR.
0 1	2 5	9 0

FOR NEW FACILITIES, PROVIDE THE DATE (mo., day, & yr.) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (place an "X" below and complete Section I above)

☐ 1. FACILITY HAS AN INTERIM STATUS PERMIT

☐ 2. FACILITY HAS A FINAL PERMIT

III. PROCESSES — CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (including its design capacity) in the space provided on the (Section III-C).

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (barrel, drum, etc.)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D80	GALLONS OR LITERS
LANDFILL	D81	ACRE-FEET (the volume that would cover one acre to a depth of one foot) OR HECTARE-METER
LAND APPLICATION	D82	ACRES OR HECTARES
OCEAN DISPOSAL	D83	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D84	GALLONS OR LITERS

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Section III-C.)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING SECTION III (shown in line numbers X-1 and X-2 below): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 5	6,000,000 *	G		7				
2	T 0 4	14,000	U		8				
3									
4									

* Process Code S05 is being utilized to designate the 600 Area Purgewater Storage and Treatment Facility as 'miscellaneous units' per the proposed Washington State Dangerous Waste Regulation 173-303 'Subpart X'.

Continued from the front

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESS (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY

S05 - The 600 Area Purge Water Storage and Treatment Facility consists of six above ground 1,000,000 gallon miscellaneous units, with a combined total capacity of 6,000,000 gallons. These units are located in the 600 Area, north of the 216-B-3 Pond. The purgewater storage and treatment miscellaneous units are used for interim storage and treatment of purgewater generated from the groundwater monitoring wells located throughout the Hanford Site. The purgewater is generated when a groundwater monitoring well is developed or groundwater samples are obtained. The purgewater from a groundwater monitoring well is transported by tank truck and pumped directly into the 600 Area miscellaneous units.

T04 - Treatment of the purgewater by evaporation is carried out in the six 600 Area miscellaneous units. Approximately 14,000 gallons per day of purgewater can be treated by solar evaporation based upon the evaporation rates calculated for the Hanford Site and assuming all six miscellaneous units are in use.

IV. DESCRIPTION OF DANGEROUS WASTES

A. **DANGEROUS WASTE NUMBER** — Enter the four digit number from Chapter 173-303 WAC for each listed dangerous waste you will handle. If you handle dangerous wastes which are not listed in Chapter 173-303 WAC, enter the four digit number(s) that describes the characteristics and/or the toxic contaminants of those dangerous wastes.

B. **ESTIMATED ANNUAL QUANTITY** — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non—listed waste(s) that will be handled which possess that characteristic or contaminant.

C. **UNIT OF MEASURE** — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. **PROCESS CODES:**

For listed dangerous waste: For each listed dangerous waste entered in column A select the code(s) from the list of process codes contained in Section III to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non—listed dangerous wastes: For each characteristic or toxic contaminant entered in Column A, select the code(s) from the list of process codes contained in Section III to indicate all the processes that will be used to store, treat, and/or dispose of all the non—listed dangerous wastes that possess that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

2. **PROCESS DESCRIPTION:** If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: DANGEROUS WASTES DESCRIBED BY MORE THAN ONE DANGEROUS WASTE NUMBER — Dangerous wastes that can be described by more than one Waste Number shall be described on the form as follows:

1. Select one of the Dangerous Waste Numbers and enter it in column A. On the same line complete columns B, C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other Dangerous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other Dangerous Waste Number that can be used to describe the dangerous waste.

EXAMPLE FOR COMPLETING SECTION IV (*shown in line numbers X-1, X-2, X-3, and X-4 below*) — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non—listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
X-2	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2			T 0 3 D 8 0	included with above

CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER (enter from page 1)

W A 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F001	50,072,346	P	S05	Storage/Miscellaneous Units
2	F002	↓	↓	↓	↓
3	F003	↓	↓	↓	Included With Above
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

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Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

I.D. NUMBER (enter from page 1)

W A 7 8 9 0 0 0 8 9 6 7

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

LINE NO.	A. DANGEROUS WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F001	42,644,948	P	T04	Treatment/Other/Evaporation (Miscellaneous Units)
2	F002				
3	F003				Included With Above
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					

9413293.3719

Continued from the front

IV. DESCRIPTION OF DANGEROUS WASTES (continued)

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM SECTION D(1) ON PAGE 3.

The purgewater that is stored and treated in the 600 Area miscellaneous units comes from groundwater monitoring wells located throughout the Hanford Site.

The estimated annual quantity of waste indicated is based upon the maximum projected storage and treatment capacities of the miscellaneous units. The volumes resulting from well sampling and well development activities can be estimated, however the volumes resulting from aquifer testing are still unknown.

Materials stored in this facility may potentially include the nonspecific waste codes F001, F002, and F003.

This Part A permit application is being submitted as a protective filing in order that this facility may be authorized to store regulated waste. This facility will also be used to store non-regulated purgewater.

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility (see instructions for more detail).

VI. PHOTOGRAPHS

All existing facilities must include photographs (aerial or ground—level) that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas (see instructions for more detail).

VII. FACILITY GEOGRAPHIC LOCATION

This information is provided on attached drawings and photographs

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
Michael J. Lawrence Manager, Richland Operations United States Department of Energy	Michael J. Lawrence	2-20-90

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

NAME (print or type)	SIGNATURE	DATE SIGNED
SEE ATTACHMENT		

9413293.3721

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment.

John E. Nolan

Co-operator
John E. Nolan, President
Westinghouse Hanford Company

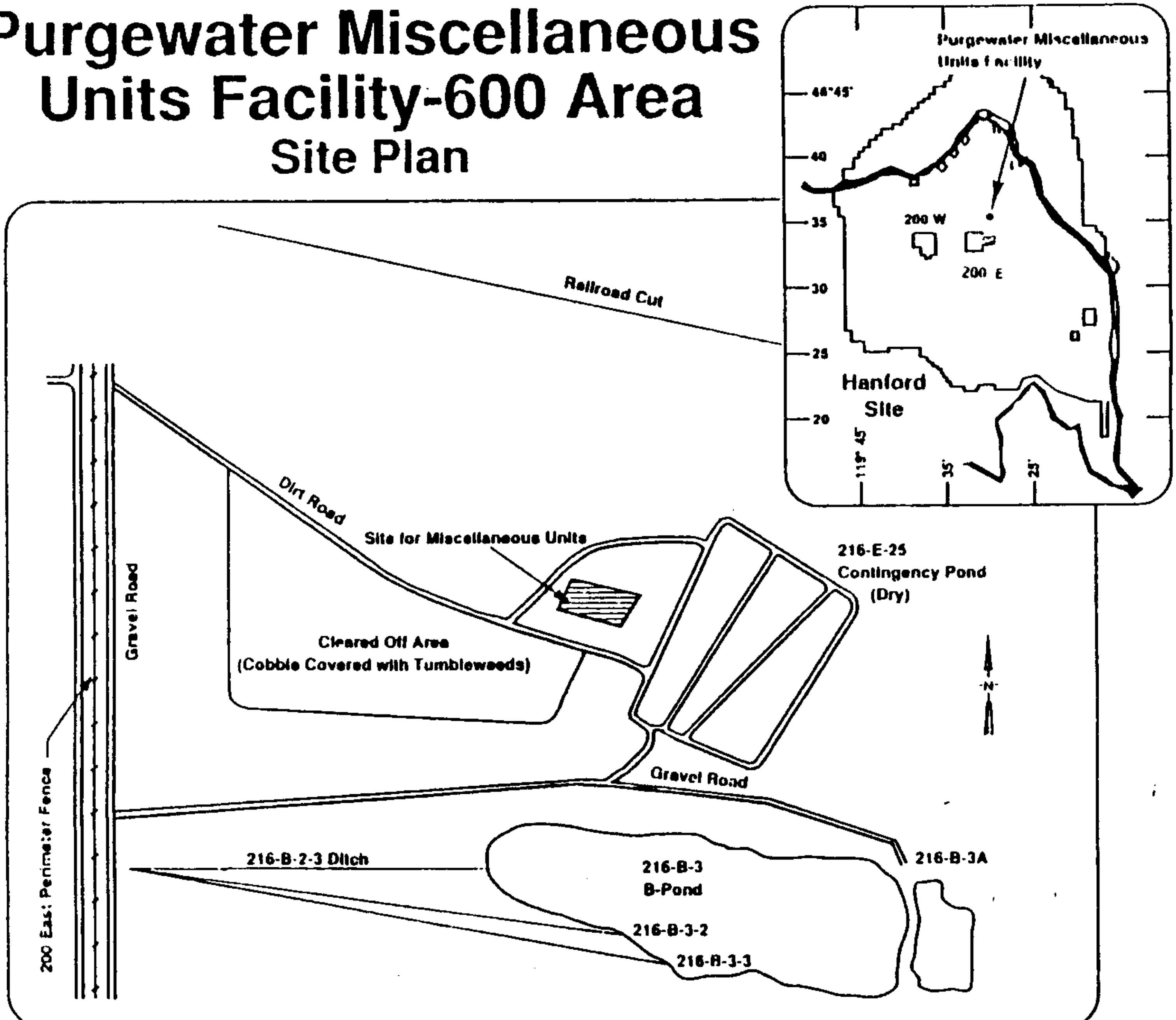
1/18/90
Date

Michael J. Lawrence

Owner/Operator
Michael J. Lawrence, Manager
U.S. Department of Energy
Richland Operations Office

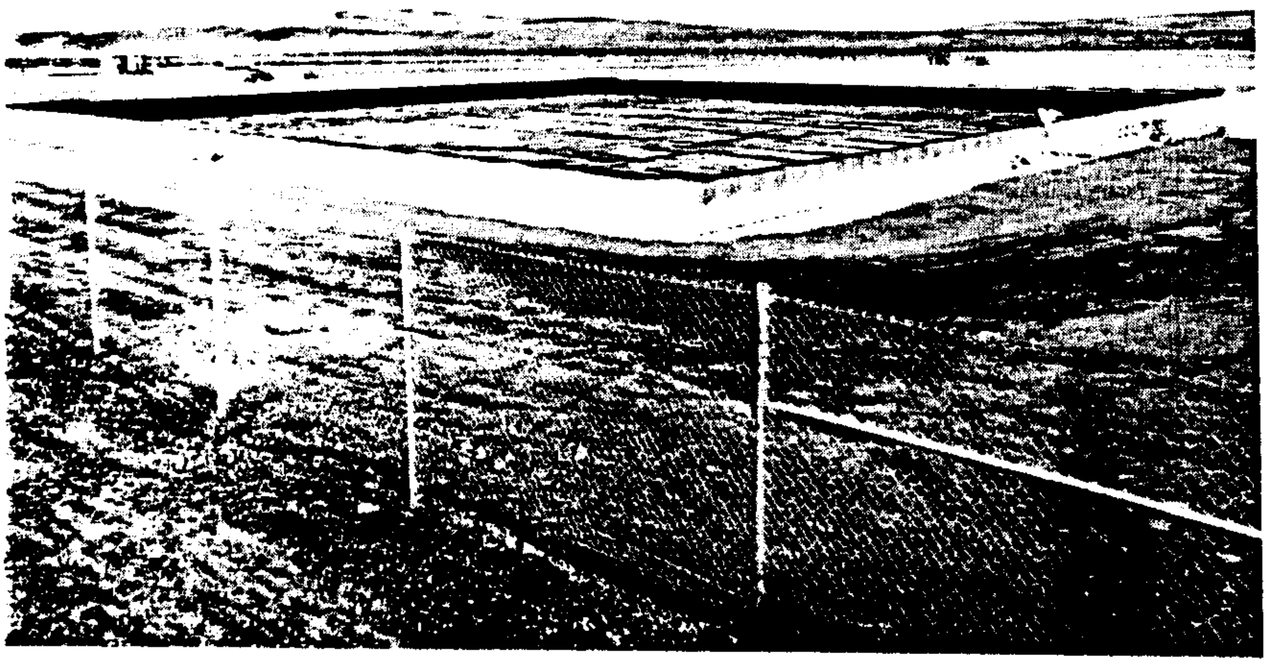
2-20-90
Date

Purgewater Miscellaneous Units Facility-600 Area
Site Plan



78911068.2

600 AREA PURGEWATER STORAGE AND TREATMENT FACILITY MISCELLANEOUS UNIT (TYPICAL)



46°45'33"
119°45'33"

89122121-3CN
(PHOTO TAKEN 1990)

APPENDIX C

200-BP-11 OPERABLE UNIT DATA QUALITY OBJECTIVE DECISIONS/AGREEMENTS/COMMITMENTS

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

Following are the significant decisions, agreements, and commitments reached between the Washington State Department of Ecology, U.S. Environmental Protection Agency, Department of Energy (Richland Office), and Westinghouse Hanford Company as a result of the Data Quality Objective process performed for the *Integrated 200-BP-11 Operable Unit and 216-B-3 Main Pond Work/Closure Plan (DOE/RL-93-74)*.

9413293.3726

Robert G. McLeod 6-21-94
DOE Field Office, Richland

Paul A Beam 6/27/94
U.S. Environmental Protection Agency

Jerry Yokel 6-8-94
Washington State Department of Ecology, CERCLA

Jeanne J Wallace 6/8/94
Washington State Department of Ecology, RCRA

Robert Jeanbaptiste 6/8/94
Westinghouse Hanford Company

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

1. Assumptions.

   a. The 216-B-3A, -3B, and -3C Expansion Pond TSD unit will be clean closed as described in the *216-B-3 Expansion Ponds Closure Plan*, DOE/RL-89-28, Rev. 1.

   b. Quality Assurance Project Plans (QAPjPs) and Sampling and Analysis Plans (SAPs) will meet both RCRA TSD and RCRA Past-Practice DQOs.

   c. The 200-BP-11 Operable Unit (OU) meets the Model Toxics Control Act (MTCA) definition of Industrial, thus the future land use for the 200-BP-11 (OU) is Industrial.

   d. Risk assessments will use a 200 Area Industrial scenario and be incorporated into the Hanford Site Baseline Risk Assessment Methodology (HSBRAM).

   e. Waste might be left in place in the OU.

   f. RCRA TSDs in the OU may be closed as landfills or modified clean closure.

   g. The same cleanup standards will apply to the TSD and the Past-Practice waste management units within the OU. However, analytical requirements for the units will differ as specified in Items 5 and 12 below.

   h. Document review cycles will be the more stringent between Closure/Postclosure Plans (TSDs) and Work Plans (Past-Practice).

2. Statistical Sampling Approach.

   Upon evaluation by WHC, MacTec, Enserch (Ebasco), and PNL statisticians, it was agreed that currently available data is not representative for the area under study (all 200-BP-11 waste management units). Additional information required to compute the needed sample size (number of samples) are: the acceptable Type I and Type II error rates; the difference (between the mean concentration and applicable cleanup standard) that is important for the test to detect; the estimates of variabilities (lateral and vertical); and exposure unit.

   Therefore, a phased approach will be taken toward characterization of the operable unit and Phase 1 (Pilot Study) sampling will be engineered biased (i.e., sample in locations expected to have highest contaminant concentrations). Phase 1 sampling data will be evaluated (distribution, frequency, validation, variability, contamination levels, regulatory guidelines, etc.) to aid in the assessment of characterization activities following Phase 1.

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

3. Phase 1 Sampling Objective. Below are the key objectives of Phase 1 sampling.

   a. Assess site contamination to Industrial Cleanup Standards (MTCA C for dangerous waste and HSBRAM [Hanford Site Baseline Risk Assessment Methodology] for radionuclides). However, the analyses provided in support of characterization will have practical quantitation limits below the Residential Cleanup Standards (MTCA B for dangerous waste and HSBRAM for radionuclides) or Site Background to support an evaluation of clean closure or modified closure for the TSD (Main Pond and 216-B-3-3 Ditch).

   b. Answer the question -- is an Interim Remedial Measure (IRM) justified?

   c. Provide data for a qualitative/quantitative risk assessment.

   Note that groundwater sampling is beyond the scope of the 200-BP-11 characterization activities, but groundwater contamination and monitoring will need to be addressed prior to closure of the TSDs. Additionally, prior to borehole drilling, groundwater personnel will be contacted to assess their need for a groundwater boreholes.

4. The agreed-to Contaminants of Concern (COC), Practical Quantitation Limits (PQL), Minimum Detection Limits (MDL), Analytical Methods, and Cleanup Standards for the operable unit are provided in Attachment 1. The agreements that are inherent to Attachment 1 follow:

   a. Analytical methods will be SW-846 with standalone deliverables for all validated data packages (boreholes plus 20% of remaining packages). Summary deliverables will be acceptable for all other data packages. (Validation is discussed under Item 14)

   b. Non-detects will be reported as less than the PQL or MDL concentration number. Other calculations can be reported if requested.

   c. The following compounds do not have readily available methods and have a low probability of being present and will be identified and estimated in concentration as Tentatively Identified Compounds (TICs): 1-butanol (8240), ethyl ether (8240), formaldehyde (8270), acetate (8270), and kerosene (8270).

   d. Tributylphosphate (TBP) is not on any standard analyte list. The laboratory will calibrate for this compound during the 8270 analysis and will quantitate each sample for this analyte. PQLs will be determined and reported for this analyte. This is a requirement for whatever lab is performing the analyses.

   e. Hydrazine will not be analyzed because it will have decomposed.

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

f. Nitrate and nitrite will be examined for all samples using both method 300 (ion chromatography with a 48 hour holding time) and Method 353 (28 day holding time). (Method 300 is also used for sulfate/sulfite and therefore there is no cost increase to report nitrite/nitrate and compare to the Method 353 results.)

g. Total chromium will be analyzed using method 6010 and assumed as chromium six.

5. Supplementary Analyses.

To facilitate RCRA TSD concerns, a subset of samples will be analyzed for a "modified" 40 CFR 264 Appendix IX groundwater monitoring list. The modified Appendix IX list for the 200-BP-11 operable unit is defined as the Appendix IX analytical methods minus analyses for phosphorous pesticides (method 8140), herbicides (method 8150), dioxins (method 8280), and non-halogenated volatile organics (method 8015). The non-halogenated volatile organics (e.g. kerosene) will be analyzed as TICs using method 8240B and 8270B. The sample locations for these supplementary requirements are discussed in Item 12.

6. Pre-Work/Closure Plan Sampling

Sediment samples will not be taken prior to interim stabilization of the Main Pond and 216-B-3-3 Ditch, but that sediment samples would be taken in conjunction with other sampling activities, e.g., boreholes and augers.

7. Sampling Design and Approach.

a. The sampling design for Phase 1 sampling is provided in Attachment 2. (Note that augers may be substituted for a test pit pending health physics approval to use test pits.)

b. Phase 1, Task 1 -- Sampling will be performed to assess the question; is hazardous constituents or radionuclide contamination present in concentrations greater than Industrial Cleanup Standards (MTCA C and HSBRAM, respectively)?

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

7. (cont.)

   c. Phase 1, Task 2 -- The extent of this sampling effort will be defined after evaluation (Limited Field Investigation Report) of the sampling results from Task 1. Possible scenarios include:

      i. If contamination concentrations are established between Residential and Industrial Cleanup Standards, then sample to further prove the absence of hazardous constituents and radionuclide contamination above Industrial Cleanup Standards. This task should fulfill sampling requirements to support modified closure.

      ii. If contamination concentrations are established below Residential Standards for hazardous waste and below Industrial Standards for radionuclides, then sampling may be performed to "clean close" the TSD, if feasible. Feasibility will depend on the benefits of clean closure versus additional sampling cost. If clean closure is not feasible, then sample per (i.) above.

      iii. If contamination is established above Industrial Standards, ascertain the extent of contamination above these cleanup standards. (Note that this scenario was originally referred to as "Phase 2.")

8. Field Screening and Sampling Criteria.

   a. All samples and cuttings will be field screened for evidence of volatile organics and radionuclides. Volatiles will be screened by the field geologist or other qualified personnel using an organic vapor monitor. Radionuclides will be screened by alpha and gamma counting instruments. Either a FID (flame ionization detector) or PID (photoionization detector) can be used to detect volatile organics.

   b. The sampling criteria for radionuclide screening is twice background. The sampling criteria for volatile organic screening is 5 ppm. The intent of these criteria is to trigger assessment for sampling. The field geologist will make this assessment, i.e., if there are many locations above the criteria, the field geologist will determine when and where the samples should be taken.

      Note that surface samples are not planned and thus field screening and/or rad surveys will be used to assess surface sampling locations.

   c. Local area background radiation will be determined by taking a background reading using the above instruments at an pre-agreed local site in the field, e.g. the Contingency Pond. The local area background will be measured on freshly disturbed surface soil, holding the instruments less than 2 cm (1 in.) from the soil. The background readings may be taken daily depending on meteorology, e.g., inversions, wind, etc."

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

9. Sampling Locations at Depth.

   a. Sampling from surface to sediment: If surface radiation is twice background (or greater) at a sampling location, then a sample will be taken at the surface. If the surface radiation is not twice background, then a sample will be taken about 2 to 6 feet below the surface. If the waste management unit sediments are within this 2 to 6 foot range, then a sediment sample will be taken.

   b. Sampling below sediment: Samples below the sediments will be taken at lithological interfaces as determined by the field geologist, hot spots, and/or at predetermined depths.

      i. **Lithological Changes.** Estimates of lithologic changes will be made using current stratigraphy maps. The field geologist will make the determination of significant lithologic changes for sampling.

      ii. **Hot Spots.** The field geologist or other qualified person will make the determination as to when to sample a hot spot. Typically, the first indication of a hot spot (as defined in 8b above) will be sampled. In shallow boreholes, augers, and test pits, field screening and potential sampling will continue to a minimum of 5 feet below the last hot spots.

      iii. **Pre-established Depths.** Pre-established sampling depths will be used primarily only in the absence of lithologic interfaces and hot spots, and apply below the sediment surfaces only. Predetermined sampling depths are as follows:

         - Groundwater borehole -- 2, 5, 10, 20, 30, 40, 50, 75, 100, and 150 ft., with an additional sample (if possible above the water table ($\approx$200ft.).

         - Shallow boreholes -- 2, 5, 10, 20, 30, 40, and 50 ft.

         - Augers and Test Pits -- 2, 5, 10, 15, and 20 ft. (Note that augers may be substituted for a test pit pending HPT approval to use test pits.)

10. Perched Water Samples.

If perched water is encountered in a boring, a perched water well will be installed that is screened against the water-bearing interval. Normally one sample will be taken. However, for inorganics, two samples will be collected per well: one will be unfiltered, and a second will be filtered through a 0.45 micron filter onsite before being bottled and preserved. These samples will also be analyzed for the modified Appendix IX list plus fluoride, C-14, and tritium.

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

11. Physical Sample Analyses.

Samples will be taken at major lithologies within boreholes and analyzed for physical properties such as:

- Bulk density
- Particle size distribution
- Moisture content
- pH
- Unsaturated hydraulic conductivity

These locations and properties will be further assessed by groundwater flow and mass transport modeling personnel during work/closure plan preparation and review.

12. Location of Modified Appendix IX Samples.

a. All the samples taken within the RCRA TSD during Phase 1, Task 1, will include analyses for the complete list of contaminants of concern (COC) plus the modified Appendix IX contaminants as discussed in Item 5 above.

b. Samples taken within the RCRA Past-Practice units need only be sampled for the COC as listed in Attachment 1.

c. Depending upon the sample result from Phase 1, Task 1; if results indicate species > MTCA B, but < MTCA C cleanup standards, then modified closure will be discussed pending issuance of the site wide permit. Additional sampling may occur and the determination of the analyses required will be discussed at that time.

d. If clean closure (<MTCA B) proves an option based upon Phase 1, Task 1 sampling results, then additional verification samples within the TSD will require the complete COC list plus the modified Appendix IX.

200-BP-11 Operable Unit Data Quality Objective

Decisions/Agreements/Commitments

13. Priority of Analyses.

Field screening for radiation will be performed on the loose soil from the drill casing.

When there is sufficient sample size, VOA analysis will always be performed first. Other analyses will be performed in a sequence which will yield best results.

If there is insufficient sample size, then the following will be the analytical priority:

RCRA Past-Practice and TSD units	Perched Water
Rad	Rad
Metals	Metals
Semi-VOA	VOA
VOA	Semi-VOA
General Chemistry	General Chem
Physical	Physical

14. Sample Validation.

a. 100% validation of borehole samples.
b. Minimum 20% validation on remaining data packages from test pits and auger samples.

		POTENTIAL INORGANIC CONTAMINANTS OF CONCERN FOR THE 200-BP-11 OPERABLE UNIT										
CONTAMINANT	ORAL RfD	ORAL SF	PQL	HSBRAM (mg/kg)				MTCA (mg/kg)				ANALYTICAL
			(mg/kg	Residential		Industrial		Method "B"		Method "C"		
	(mg/kg-d)	(mg/kg-d)-1	or ppm)	non-carc.	carcino.	non-carc.	carcino.	non-carc.	carcino.	non-carc.	carcino.	METHOD
Arsenic	3.0E-04	1.7	10 or 0.3	2.40E+01	3.76E-01	1.05E+03	7.10E+00	2.40E+01	5.90E-01	1.05E+02	7.60E+01	GFAA/6010 or 7060
Barium	7.0E-02	NC	1	5.60E+03		2.45E+05		5.60E+03		2.45E+05		ICP/6010
Beryllium	5.0E-03	4.3	1	4.00E+02	1.50E-01	1.75E+04	2.80E+00	4.00E+02	2.33E-01	1.75E+04	3.10E+01	ICP/6010
Bismuth	NF	NF	7									AA
Boron	9.0E-02	NC	10	7.2E+03		3.2E+05		7.2E+03		3.2E+05		ICP/6010
Cadmium	1.0E-03	NC	2	8.00E+01		3.50E+03		8.00E+01		3.50E+03		ICP/6010
Chromium (VI) (a)	1.0E+00	NC	2	4.00E+02		1.75E+04		4.00E+02		1.75E+04		ICP/6010
Copper	4.0E-02	NC	2	3.20E+03		1.40E+05		3.20E+03		1.40E+05		ICP/6010
Iron	NT	NC	10									ICP/6010
Lead	ND	ND	10 or 0.3									ICP/6010 or 7421
Manganese	1.4E-01	NC	1	1.12E+04		4.90E+05		1.12E+04		4.90E+05		ICP/6010
Mercury	3.0E-04	NC	0.1	2.40E+01		1.05E+03		2.40E+01		1.05E+03		AA/7471
Nickel	2.0E-02	NC	4	1.60E+03		7.00E+04		1.60E+03		7.00E+04		ICP/6010
Potassium			500									ICP/6010
Selenium		NC	25 or 0.3	4.00E+02				4.00E+02		1.75E+04		GFAA/6010 or 7740
Silver		NC	20	4.00E+02				2.40E+02		1.75E+04		ICP/6010
Tin	6.0E-01	NC	50	4.80E+04		2.10E+06		4.80E+02		2.10E+06		ICP/7870
Uranium (b)	3.0E-03	ND		2.40E+02		1.05E+04		2.40E+02		1.05E+04		ICP/6010
Vanadium	7.0E-03	NC	2	5.60E+02		2.45E+04		5.60E+02		2.45E+04		ICP/6010
Zinc	3.0E-01	NC	2	2.40E+04		1.05E+06		2.40E+04		1.05E+06		ICP/6010

NC = Not classified as a carcinogen or not carcinogenic via this exposure route.
ND = No EPA toxicity data (but compound present in IRIS or HEAST)
NF = This compound not present in IRIS or HEAST
W= Toxicity data withdrawn from HEAST or IRIS
CLP = Contract Laboratory Procedure
IC = Ion Chromotography
VOA = Volatile Organics Analysis
GCFID = Gas Chromatograph Flame Ionization Detector
Note: HSBRAM Risk Based Concentrations based on HQ = 1 and ICR = 1E-06.
(a) Cr-VI will be analyzed as total Cr
(b) Uranium (soluble salts) toxicity values for chemical (not radioactive) characteristics. See radionuclide tables for rad values.

POTENTIAL VOLATILE ORGANIC, SEMI-VOLATILE ORGANIC, AND OTHER INORGANIC CONTAMINANTS OF CONCERN FOR THE 200-BP-11 OPERABALE UNIT

				HSBRAM (mg/Kg)				MTCA (mg/Kg)				
	ORAL RfD	ORAL SF	PQL	Residential		Industrial		Method "B"		Method "C"		ANALYTICAL
CONTAMINANT	(mg/kg-d)	(mg/kg-d)-1	(ug/L)	non-carc.	carcino.	non-carc.	carcino.	non-carc.	carcino.	non-carc.	carcino.	METHOD
Other Inorganics												
Acetate (from acetic acid)	NF	NF	?									8270 TIC
Ammonia	34 mg/L (a)	NC	30 (b)					Method A				350.2
Cyanide (total)	2.0E-02	NC	0.78 (b)	1.60E+03		7.00E+04		1.60E+03		7.00E+04		Colorimetric/CLP Metals/9010
Flouride	6.0E-02	NC	6 (b)	3.20E+03		1.40E+05		3.20E+03		1.40E+05		IC/300
Nitrate	1.6E+00	NC	61 (b)	1.30E+05		5.60E+06		1.30E+05		5.60E+06		IC/300 & 353
Nitrite (as N)	1.0E-01	NC	100 (b)	8.00E+03		8.00E+03		8.00E+03		3.50E+05		IC/300 & 353
Sulfate (from sulfuric acid)	ND	ND	160 (b)									IC/300
Volatile Orgnnics			PQL (ug/kg)									
Acetone	1.0E-01	NC	10	8.00E+03		3.50E+06		8.00E+03		3.50E+06		VOA/8240
Butanol, 1-	1.0E-01	NC		8.00E+03		3.50E+06		8.00E+03		3.50E+06		8240 TIC
Butanone, 2- (MEK)	6.0E-01	ND	10	4.80E+04		2.10E+06		4.80E+04		2.10E+06		VOA/8240
Carbon tetrachloride	7.0E-04	1.3E-01	5	5.60E+01	4.92E+00	2.45E+03	9.23E+01	5.60E+01	7.69E+00	2.45E+03	1.00E+03	VOA/8240
Chloroform	1.0E-02	6.1E-03	5	8.00E+02	1.05E+02	3.50E+04	1.97E+03	8.00E+02	1.64E+02	3.50E+04	2.13E+04	VOA/8240
Ethyl ether	2.0E-01	NC		1.60E+04		7.00E+05		1.60E+04		1.75E+06		8240 TIC
Methylene chloride	6.0E-02	7.5E-03	5	4.80E+03	8.53E+01	2.10E+05	1.60E+03	4.80E+03	1.33E+02	2.10E+05	1.83E+04	VOA/8240
Toluene	2.0E-01	NC	5	1.60E+04		7.00E+05		1.60E+04		7.00E+05		VOA/8240
Trichloroethane, 1,1,1-	ND	NC	5					7.20E+03		3.20E+05		VOA/8240
Trichloroethane, 1,1,2-	4.0E-03	5.7E-02	5		1.10E+01	1.40E+04	2.10E+02	3.20E+02	1.80E+01	1.40E+04	2.30E+03	VOA/8240
Semivolatile Organics			PQL (ug/kg)									
Formaldehyde	2.0E-01	ND		1.60E+04		7.00E+05			3.30E+01		4.40E+03	8270 TIC
Hydrazine	ND	3.0E+00			2.13E-01		4.00E+00		3.33E-01		4.33E+01	Will not be analyzed
Kerosene	NF	NF	5,000									8270 TIC
PCBs	ND	7.7E+00	21 or 33		8.30E-02		1.60E+00		1.30E-01		1.70E+01	8080 (PCBs 1242 = 21; all others = 33)
Tributyl phosphate	5.0E-03	NC		4.00E+02		1.80E+04		4.00E+02		1.80E+04		8270 (special calibration)
Naphthalene	4.0E-03	NC	660	3.20E+02		1.40E+04		3.20E+02		1.40E+04		8270

NC = Not classified as a carcinogen or not carcinogenic via this exposure route.
ND = No EPA toxicity data (but compound present in IRIS or HEAST)
NF = This compound not present in IRIS or HEAST
CLP = Contract Laboratory Procedure
IC = Ion Chromotography
VOA = Volatile Organics Analysis
GCFID = Gas Chromatograph Flame Ionization Detector
Note: HSBRAM Risk Based Concentrations based on HQ = 1 and ICR = 1E-06.
(a) Ammonia concentration in drinking water, specifically related to organoleptic threshold
(b) Listed quantitation limits are for water. Quantitation limits are highly matrix dependent and will be higher in soils.

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POTENTIAL RADIONUCLIDE CONTAMINANTS OF CONCERN FOR THE 200-BP-11 OPERABLE UNIT

RADIONUCLIDE	MDA (pCi/g)	INDUSTRIAL HSBRAM (pCi/g) Oral SF 1/pCi	Soil Ingestion by Children/Adults	Oral SF 1/pCi	Dust Inhalation by Adults	ANALYTICAL METHOD	COMMENTS
Gross Alpha	10.00					Gas Proportional	
Gross Beta	15.00					"	
Cesium-137 (Ba-137m)	0.10	2.80E-11	2.50E+02	1.90E-11	1.10E+04	Gamma Spectrometry	Cs-137 measured by counting Ba-137m
Cobalt-60	0.05	1.50E-11	4.60E+02	1.50E-10	1.30E+03	"	
Europium-152	0.10	2.10E-12	3.30E+03	1.10E-10	1.80E+03	"	
Europium-154	0.10	3.00E-12	2.30E+03	1.40E-10	1.40E+03	"	
Europium-155	0.10	4.50E-13	1.50E+04	1.80E-11	1.10E+04	"	
Uranium-235 (Pa-231)		1.60E-11	4.30E+02	2.50E-08	8.00E+00	"	U-235 measured by counting Pa-231
Americium-241	1.00	2.40E-10	2.90E+01	3.20E-08	6.30E+00	Alpha Spectometry	May also use gamma spectrometry
Curium-244	1.00	1.60E-10	4.30E+01	2.20E-08	9.10E+00	"	
Neptunium-237	1.00	2.20E-10	3.10E+01	2.90E-08	6.90E+00	"	
Plutonium-238	1.00	2.20E-10	3.10E+01	3.90E-08	5.10E+00	"	
Plutonium-239/240	1.00	2.30E-10	3.00E+01	3.90E-08	5.30E+00	"	
Plutonium-241	15.00	3.60E-12	1.90E+03	2.30E-10	8.70E+02	"	
Thorium-228		5.50E-11	1.30E+02	7.80E-08	2.60E+00	"	
Thorium-230	1.00	1.30E-11	5.30E+02	2.90E-08	6.90E+00	"	
Thorium-232	1.00	1.20E-11	5.80E+02	2.80E-08	7.10E+00	"	
Uranium-233/234		1.60E-11	4.30E+02	2.70E-08	7.40E+00	"	Most U-233/234 samples measured
Uranium-235	1.00	1.60E-11	4.30E+02	2.50E-08	8.00E+00	"	by counting Pa-231m
Uranium-236		1.50E-11	4.60E+02	2.50E-08	8.00E+00	"	
Uranium-238		2.80E-11	2.50E+02	5.20E-08	3.80E+00	"	
Iodine-129	2.00	1.90E-10	3.60E+01	1.20E-10	1.70E+03	Beta Counting	
Strontium-90 (Y-90)	1.00	3.60E-11	1.90E+02	6.20E-11	3.20E+03	"	Sr-90 measured by counting
Technetium-99	15.00	1.30E-12	5.30E+03	8.30E-12	2.40E+04	"	counting Y-90
Selenium-79	5.00	5.80E-12	1.20E+03	6.00E-12	3.30E+04	"	
Samarium-151		1.10E-13	6.30E+04	8.70E-12	2.30E+04	"	
Carbon-14	50.00	9.00E-13	7.70E+03	6.40E-15	3.10E+07	Liquid scintillation	C-14 & H-3 not applicable
Tritium (H-3)	400.00	5.30E-14	1.30E+05	7.80E-14	2.60E+06		for soil samples

HSBRAM = Hanford-Site Baseline Risk Assessment Methodology (DOE-RL 1993)
Risk-based concentrations at incremental cancer risk level of 1E-06 for an industrial scenario based on assumptions in the HSBRAM, Rev.2
MDA = Minimum Detectable Activities
Oral Slope factors from Health Effects Assessment Summary Tables (HEAST, EPA 1992)
Shaded areas indicate cleanup standard for the 200-BP-11 Operable Unit

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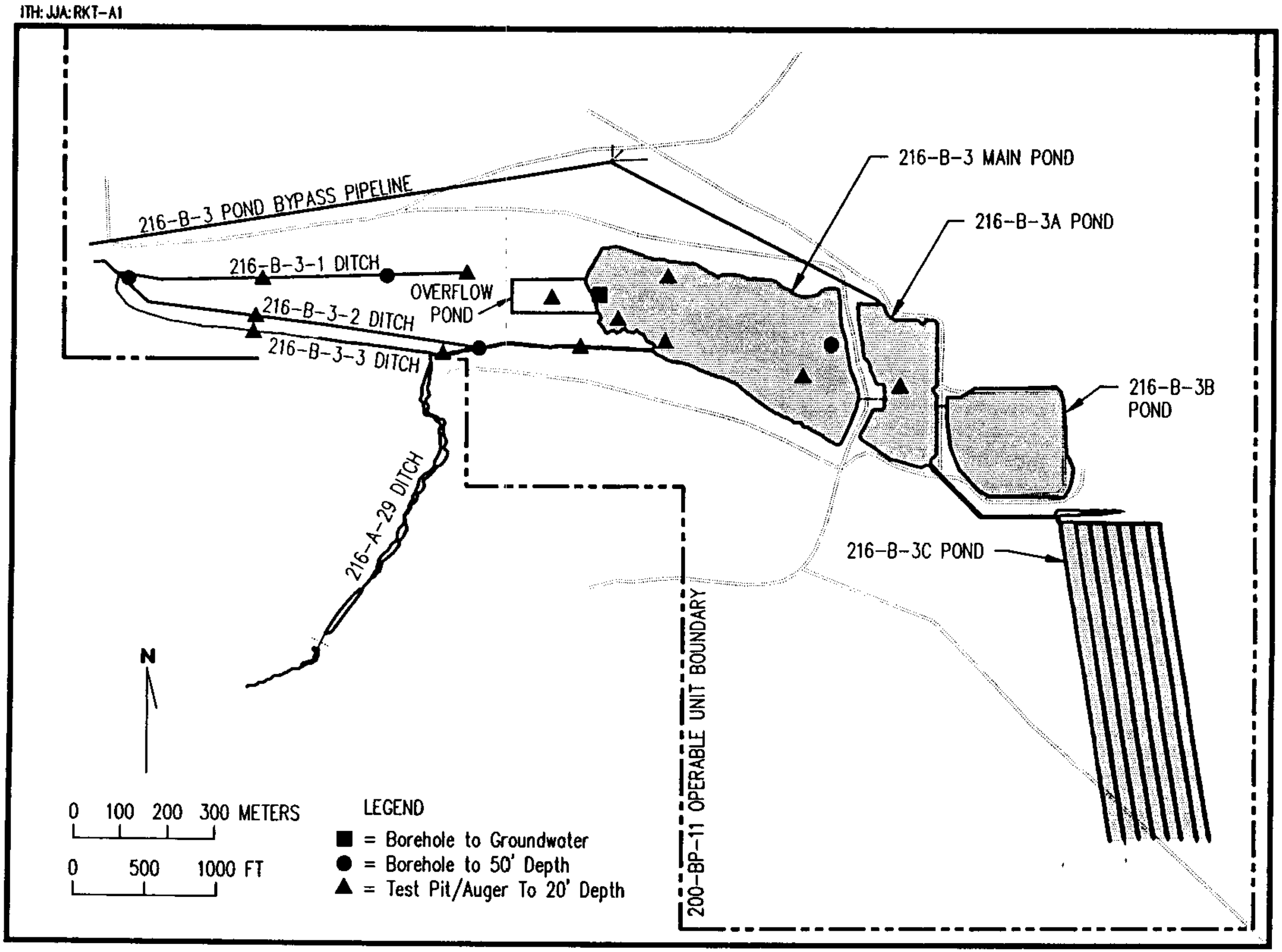

Attachment 2
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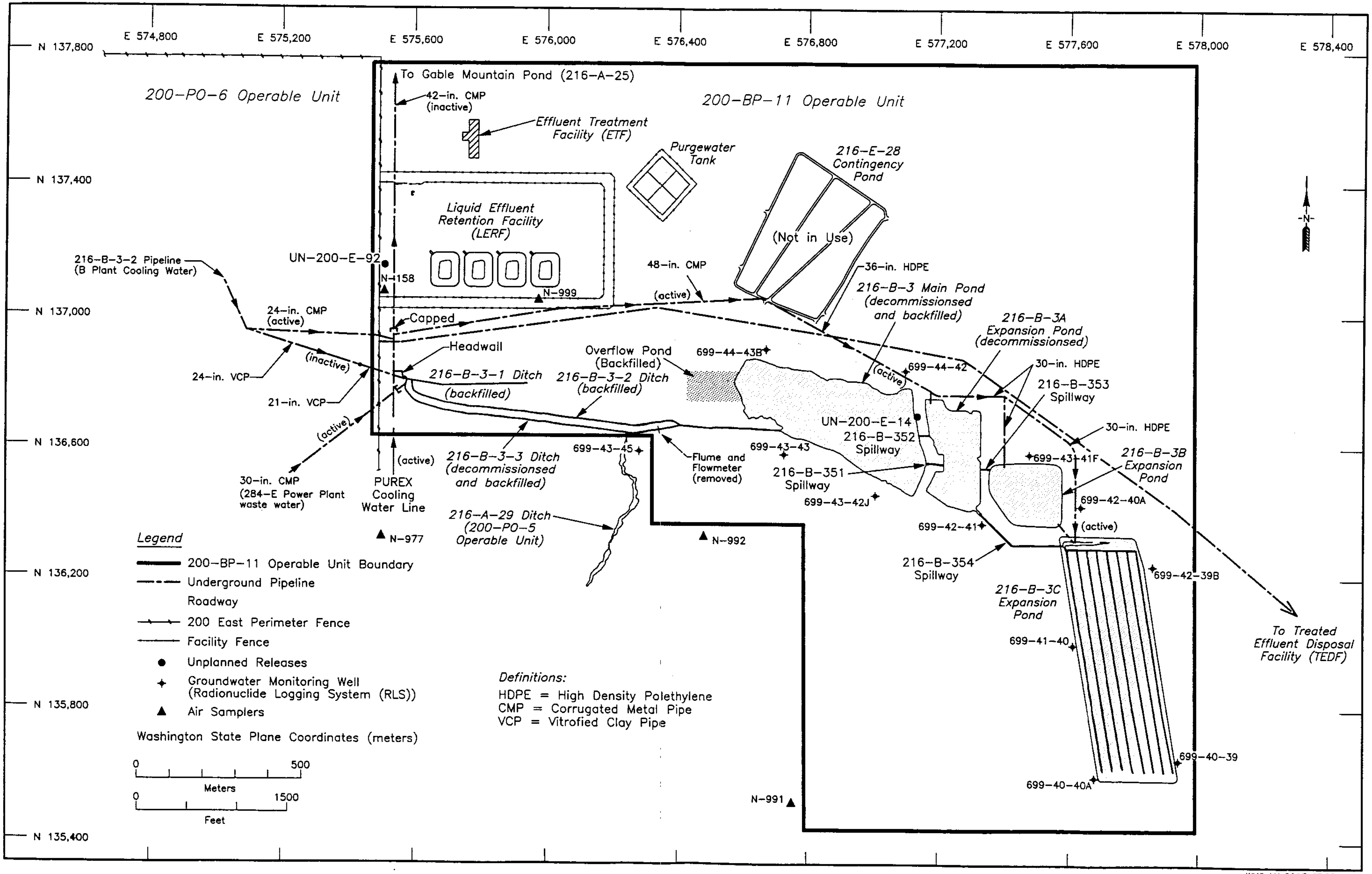

WHC:JJA:200EAST:BP110U

PLATE 1
200-BP-1 OPERABLE UNIT MAP

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